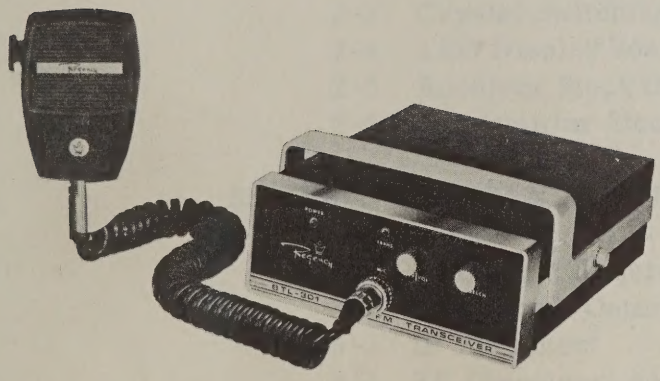
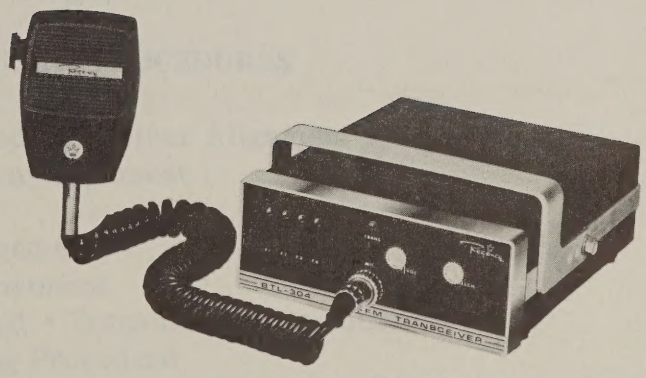
Regency ELECTRONICS INC.

SERVICE MANUAL



BTL-301



BTL-304

MODELS BTL-301 BTL-304

VHF FM TRANSCEIVER

7707 RECORDS STREET
INDIANAPOLIS, INDIANA 46226

PRINTED IN U.S.A.
3-79

PRICE $5.00
SM-10-451

BTL-301 AND BTL-304 SERVICE MANUAL

CONTENTS

SECTION 5 PARTS LIST

SECTION 6 SERVICE MANUAL ADDENDUM

SECTION 7 SERVICE MANUAL ADDENDUM

SECTION 8 SERVICE MANUAL ADDENDUM

SECTION 9 SERVICE MANUAL ADDENDUM

SECTION 10 C.T.C.S.S. ACCESSORY ADDENDUM

SECTION 1 GENERAL INFORMATION

1-1 DESCRIPTION

The Regency BTL-301 and BTL-304 are all-transistor, FM transceivers designed for use in the VHF (29-50 MHz) Communications Low Band. The BTL-301 and BTL-304 are, respectively, one and four channel versions of the same basic transceiver design. The transmitter and receiver sections both employ band-pass circuitry for maximum RF power output and receiver sensitivity. Receive and Transmit frequencies are both crystal controlled.

The receiver section is a double-conversion, super-hetrodyne type with a MOS FET first mixer. Silicon transistors are utilized for dependability under widely varying ambient conditions. Also, two Integrated Circuits are used, providing for compactness and circuit reliability. In addition, a ceramic filter is employed in the second I.F. for optimizing receiving performance where numerous channels are active within the same area of the country.

The transmitter section also utilizes silicon transistors throughout. Two ruggedized RF power transistors (BET or Balanced Emitter transistor type) are employed for high power output (30 watts). A large, copper heat sink ensures that there is virtually no power drop off during lengthy transmissions. In addition, an SWR bridge limiting circuit provides the necessary protection to the RF power transistors in the event the antenna or its coaxial feedline becomes open or shorted.

The transmitter employs phase modulation for the ultimate in carrier stability. Internal controls are provided for adjusting the microphone gain and for setting the amount of deviation. The deviation control is adjusted for a maximum of 5 KHz deviation, in conformance with FCC Regulations.

The attenuation of spurious emissions from the transmitter, RF power output frequency stability, performance under highly varying conditions of temperature and battery voltage, and other specifications, all exceed the limits required for Type Acceptance by the Federal Communications Commission.

NOTE: The Regency Type BTL-301 and BTL-304 Transmitters are Type Accepted under Parts 21, 89, 91 and 93 of the Federal Communications Commissions Rules and Regulations. The receiver section is Certified under Part 15, Subpart C as required by the FCC Rules and Regulations.

1-2 SPECIFICATIONS

RECEIVER

Antenna Impedance ..... 50 ohms

Channels	1 Crystal Controlled (BTL- 4 Crystal Controlled (BTL-3
Frequency Range	29-50 M
Factory Tuned In 3 Segments	29-35 MI 35-44 MI 44-50 MI
Sensitivity	0.35μv 20 DB Quieting Nomina
Selectivity	6 DB ±7.5 KHz; 70 DB ±15 KH
Spurious Rejection	60 DI
Intermodulation Rejection	60 DB
Modulation Acceptance	±7.5 KHz
Audio Output	3 Watts 10%, or less, Distortion 5 Watts Maximum
Squelch System	All Noise Compensated
I.F. System	Double Conversion 10.7 MHz – 455 KHz

Part 15 FCC Certified as follows:

Frequency Range	Receiver Certification No.
29-35 MHz	RL 14A
35-44 MHz	RL 14B
44-50 MHz	RL 14C

TRANSMITTER

Antenna Impedance	50 ohms
Channels	1 Crystal Controlled (BTL-301) 4 Crystal Controlled (BTL-304)
Frequency Range	29-50 MHz
Factory Tune Ranges (7)	29-32 MHz 32-35 MHz 35-38 MHz 38-41 MHz 41-44 MHz 44-47 MHz 47-50 MHz

Power Output	30 Watts (minimum) at 13.8 VDC
Power Bandwidth	1.0 MHz Maximum
Output Frequency Stability	0.002%, -30 to +60°C
Spurious & Harmonic Rejection	58 DB (min.)
Power Unit Protection	VSWR Bridge Limiting Protection Circuit
Emission	16F3
Mike Pre-Amp	FET Input with Internal Level Control
Microphone	High Impedance Plug-in Ceramic
Modulation	Phase Modulation with Automatic Deviation Limiting
Deviation	Factory Adjusted to ±5 KHz (max.)
Heat Sink	Solid Copper 1/8" Thick

Type Acceptance: 21, 89, 91, 93

POWER

Power Requirements	13.8 Volts (nominal)
Receive (Squelched)	180 MA.
Receive (Max. Audio Output)	800 MA.
Transmit	5.0 Amps (max.)
Fuse Size	10 Amp. 3AG

SEMICONDUCTORS

Integrated Circuits	3
Silicon Transistors (Total)	25
Silicon BET Power Transistors	2
Dual Gate MOS FET Transistor	1

Field Effect Transistors	2
Zener Diodes	2
Varicap Diodes	2
Signal Diodes	5 (BTL-301) 8 (BTL-304)
Rectifier Diode	1
Light Emitting Diodes	2 (BTL-301) 5 (BTL-304)

GENERAL FEATURES

Front Panel Size	2 5/8" x 6 1/2"
Depth (Including Knobs)	9 1/2"
Weight (Complete)	6 1/2 Lbs.
Speaker	4" Square, 3.2Ω Impedance

1-3 EQUIPMENT SUPPLIED

a. 1 - Transceiver unit
b. 1 - Microphone and Connector
c. 1 - Mobile Mounting Bracket
d. 1 - Mobile Mounting Hardware
e. 1 - Security Bracket
f. 1 - DC Power Cord and Fuse
g. 1 - Owner's Instruction Manual

1-4 EQUIPMENT NOT SUPPLIED

a. 1 - Antenna
b. 1 - Coaxial Cable feedline
c. 1 - Coaxial Cable connector
d. 1 - Power Supply (battery)
e. 1 - Pad lock (used with Security Bracket)

1-5 INSTALLATION

The BTL-301 and BTL-304 transceivers are designed for installation in a vehicle that has a 12 VDC negative ground system. The RED lead, with the fuse holder, must be connected to the positive (+) terminal side

of the battery. The BLACK lead should be connected to the negative terminal of the battery, or to a metal chassis that is grounded to the negative terminal. In the event that the battery is remotely located, it may be necessary to install additional wires for properly connecting the radio to the battery's terminals.

The antenna used should be properly adjusted for the 50 ohm output of the transmitter. A high SWR will reduce the power out, or may even shut off the transmitter entirely.

To reduce the possibility of theft, the Security Bracket should be installed as shown in Figure 1-1. The padlock used should be of substantial construction and can be either a key or combination operated type.

An external (or remotely mounted) speaker can be used by first opening the link between terminals No. 2 and No. 3. Then, connect one lead of external speaker to terminal No. 1 (chassis ground) and the other lead to terminal No. 3. The use of a 3 to 4 ohm speaker is recommended for optimum performance.

1-6 OPERATION

Volume Control/Off-On Switch:

This control varies the audio output level for the internal speaker. It also varies the level of audio present at the external speaker connection. Clockwise rotation of this control turns the receiver on and increases the volume.

Squelch Control:

This control eliminates background noise in the absence of a signal. Full clockwise rotation removes all squelch action. Turning this control counter-clockwise until the noise disappears permits the receiver to be "quiet" until an actual signal is received. Even if the squelch control is set fully counter-clockwise, the receive will still operate properly and will not be locked-out or prevented from receiving a signal.

BTL-304 Channel Selector Buttons:

The BTL-304 is capable of two-way communications on any one of four discrete, crystal-controlled frequencies, or channels. Selection of the desired channel is accomplished by pressing the corresponding channel selector button on the front panel of the unit. The radio will neither receive nor transmit unless one of these buttons is depressed so that a channel indicator lamp is on.

NOTE: Do NOT push more than one channel selector switch button in at a time.

Indicator Lamp:

BTL-301: Two LED's (Light Emitting Diode) are located on the front panel of the unit. The LED labeled "POWER" functions as a pilot lamp indicating whether the unit is turned on or off. The LED labeled "TRANS" is a transmit indicator which glows red whenever the transmitter is keyed on (activated).

BTL-304: Above each channel selector button is a LED which glows whenever its corresponding channel button is pressed. These lamps make it easy to tell at a glance which channel has been selected and to also verify that the radio is turned on. The remaining LED is a Transmit Indicator which glows whenever the transmitter is keyed on.

Microphone:

A high impedance ceramic microphone is supplied with the unit. To install the microphone on the radio set, insert the connector plug into its socket with the locating tab toward the radio. The connector is then locked into place by rotating the locking ring 1/4 turn clockwise.

To transmit a message, it is only necessary to turn the radio set on, press the push-to-talk button on the microphone and speak into the microphone. The Transmit Indicator will come on to signify that the transmitter is operating.

Best results are obtained by holding the microphone about one inch from the lips, inclined at about a 30 degree angle away from the face. Speak clearly in a normal tone of voice across the face of the microphone.

1-7 CRYSTAL SPECIFICATIONS

Minature plug-in crystals are utilized by both the receiver and transmitter sections.

The following Regency Part Number crystals are used:

Receive Crystals:	302-031
Transmit Crystals:	302-075

Crystals should be ordered by specifying the above part numbers and the exact channel frequency required.

1-8 CRYSTAL INSTALLATION

Prior to installing a crystal, the transceiver's cover will have to be removed. To remove this cover, unscrew the two large bolts located at the sides of the unit. The cover may then be slipped off by sliding it toward the rear of the unit.

Next, the speaker should be removed. Unscrew the two small metal screws (one located on each side) holding the speaker mounting brackets in place. Then carefully place the speaker assembly along side of the unit.

Insert the crystal, or crystals, in the proper socket pins as indicated on the Crystal Location Diagram, 4-9. The number by each pair of sockets matches the channel designation that appears on the front panel (BTL-304 ONLY).

For each TRANSMIT crystal, there is a variable capacitor that is to be used for "Netting" (adjusting to the exact frequency) each transmit crystal. This netting should be made with an accurate frequency counter.

NOTE: FCC Regulations require that the TRANSMIT crystal be installed and adjusted "on frequency" under the supervision of a technician holding either a First or Second Class FCC license.

After all crystals are installed, and netted, reinstall the speaker assembly. Then carefully reinstall the cover and its hardware.

SECTION 2 CIRCUIT DESCRIPTIONS

2-1 RECEIVER BOARD

The entire receiver from RF through audio output circuitry is mounted on the one receiver circuit board. The antenna is connected to an RF Bandpass Filter which acts as a preselector for incoming signals. The bandwidth of this filter is approximately 1 MHz, and consequently, the filter (L101, L102, L103) must be tuned to the portion of the band being used.

Q101 is a Dual Gate MOS FET mixer. The output of the RF Bandpass Filter is coupled to Gate 2, while the L.O. (local oscillator) output is injected into Gate 1. The output of Q101 is at the 10.7 MHz, First I.F. frequency. The gain of this stage is high enough that no RF preamplifier is needed to achieve good sensitivity.

The first L.O. (local oscillator), uses third overtone crystals. (The number marked on the crystal is the channel frequency). Oscillator injection to the mixer is accomplished by coupling the oscillator output to a tuned circuit on Gate 1 of the mixer.

The 10.7 MHz output frequency from the FET mixer is selected by T101. This output is amplified by Q103, a J-FET amplifier, and fed to an integrated circuit, IC101, which contains another amplifier for 10.7 MHz, the second mixer circuitry and the second L.O. circuitry, operating at 10.245 MHz. In some locations where a strong Image Signal has been encountered, this oscillator's frequency is moved to 11.155 MHz. (The crystal frequency is stamped on the top of the crystal).

The 455 KHz output of IC101 (terminal 5) is coupled through a tuned circuit to the input of the ceramic filter, CF-1. CF-1 is a narrow-band filter centered at 455 KHz. The excellent bandpass characteristics of CF-1 provide for very good adjacent channel rejection. The output of CF-1 is amplified by Q104 and coupled through another tuned circuit to the input of integrated circuit IC102. IC102 is a series of amplifiers providing approximately 60 DB gain at 455 KHz. Also included in IC102 is the limiting circuitry and a quadrature detector circuit. L108, connected between terminals 2 and 12 of IC102, is the adjustable quadrature coil.

The audio output from IC102 (terminal 1) is coupled to the input of the audio amplifier circuit and to the input of the noise-operated squelch circuit.

Transistor Q105 is an amplifier whose frequency response extends from approximately 5 KHz to 25 KHz. Q105 amplifies the "noise" occuring in this frequency range. The noise is coupled to the base of Q106. Q106 is used as a detector which rectifies the amplified noise and produces a DC voltage at its collector. When the DC voltage at the collector of Q106 is positive and of sufficient value to provide base bias for Q107, Q107 turns off and provides essentially a short circuit between the base of Q108 and ground. This action turns off Q108

and the audio output from the receiver is squelched (muted). When a signal (carrier) arrives, the noise input to the detector (Q106) is reduced to the point where the DC voltage at the base of Q107 is no longer sufficient to cause Q107 to conduct.

At this time, Q108 is allowed to conduct normally and the audio output of the unit is heard. With the audio preamplifier, (Q108) operating normally, audio is applied through the volume control to the base of the audio amplifier, Q109. Q109 supplies a signal to the audio driver transistors, Q110 and Q111. The output transistors, Q112 and Q113, form a quasi-complementary, transformerless stage capable of delivering 5 watts to the speaker.

2-2 TRANSMITTER BOARD

AUDIO SECTION

The audio amplifiers, Q201 and Q202, provide a high impedance input for the ceramic microphone supplied with the input and provides adjustable gain to compensate for variations in microphone characteristics. A low pass filter at the input rejects interference above the normal speech band limit of 3000 Hz. The Q202 circuitry is designed to provide a high output impedance for driving the modulation limiter circuit.

The clipper circuit (CR201 and CR202) allows signals whose amplitude is below the diodes' forward conduction threshold to pass undistorted. The peaks of large signals, however, drive the diodes into conduction where their exponential characteristic effectively limits the voltage of the signal peaks while shunting the peak currents to ground.

Q203 amplifies the output of the clipper circuit and drives the modulator circuit. Two low pass filters, one at the input of Q203 and one at the output, remove the harmonics generated by signal clipping in the Modulation Limiter circuit so that the Authorized Bandwidth is not exceeded at maximum deviation. The audio frequency response of this section meets or exceeds FCC requirements.

The deviation control (R216) in the collector circuit of Q203 sets the level of the audio signal voltage applied to the Varactor diode modulator circuit. This level is adjusted for a maximum of 5 KHz deviation with the clippers driven to full clip by a 400 Hz audio signal.

The push-to-talk (PTT) switch in the microphone applies a ground to the transmit-receive relay coil, which activates the relay. The T-R relay switches the supply voltage between the receiver and transmitter and switches the antenna between the receiver input and the transmitter output.

CRYSTAL OSCILLATOR

The Oscillator Q212 is a common collector, modified colpitts type, whose frequency is determined by one of four crystals selected by the channel selector switch. Each crystal has an associated trimmer capacitor which is used for fine frequency adjustment. When used with the specified crystal type, the oscillator meets the required frequency stability without need for crystal ovens or external compensation. The primary supply voltage to the oscillator is regulated.

DIVIDER

The Divider (IC201) is a digital frequency divider which divides the output frequency of the oscillator by four (4). The purpose of the Divider is to allow both the Oscillator and the Modulator to operate at their optimum frequencies.

MODULATOR

A varactor, phase-modulator is used.

The modulator, consisting of L206, CR205, CR204 and associated circuitry, is an anti-resonant circuit tuned to one-fourth the oscillator frequency. The square wave output of the Divider is lightly coupled to the Modulator by C241. The harmonics of this output are rejected by the selectivity of the modulator circuit so that the output of the modulator consists only of the fundamental plus modulation sidebands. By varying the voltage on the two varactor diodes, CR205 and CR204, at an audio rate, the resonant frequency and consequently the phase shift of the modulator, is varied which results in the Divider output being phase-modulated at the audio frequency. The phase modulator stage modulates with low distortion over a small phase angle. The frequency multiplier stages, which follow, increase both the frequency and the deviation to the desired value.

FREQUENCY MULTIPLIER SECTION

The Divider frequency (approximately 3 MHz), is multiplied by sixteen (16) in the multiplier section to form the carrier output frequency. The multiplier string is as follows: Q211, Doubler; Q209, Doubler; Q207, Doubler; and Q206, Doubler. A double tuned, inductively coupled circuit at the output of each multiplier stage selects the desired harmonic and provides for impedance matching between stages.

POWER OUTPUT SECTION

a. Driver and Power Amplifier

The Driver (Q205) and Power Amplifier (Q204) stages amplify the carrier signal to the required output power. Additional selectivity

against spurious emissions is provided in T202. These stages operate in the Class C mode.

b. Output Matching Network

L201, L202, C217, C218, C219 and C252 make up an output "II" matching network which transforms the output impedance of Q204 to a 50Ω resistive match at the antenna terminals. This circuit also provides selectivity which attenuates the harmonics of the carrier to below the level required by the FCC. C252 and L202 form a trap which provides additional rejection of the second harmonic. No additional low pass filter is necessary. L203 is an R.F. choke which isolates the R.F. output of Q204 from the D.C. supply buss.

c. SWR Bridge

In the event of a load mismatch at the antenna terminals, the SWR Bridge consisting of T201, R218 and CR203 will detect the mismatch and send a signal to the Driver Limiter. The Driver Limiter (Q208 and Q210) will then bias Q209 in an off condition, preventing possible damage to the power amplifier (Q204). Load mismatch is detected by comparing the phases of output voltage and current to determine if standing waves exist on the line.

2-3 CRYSTAL SWITCHING

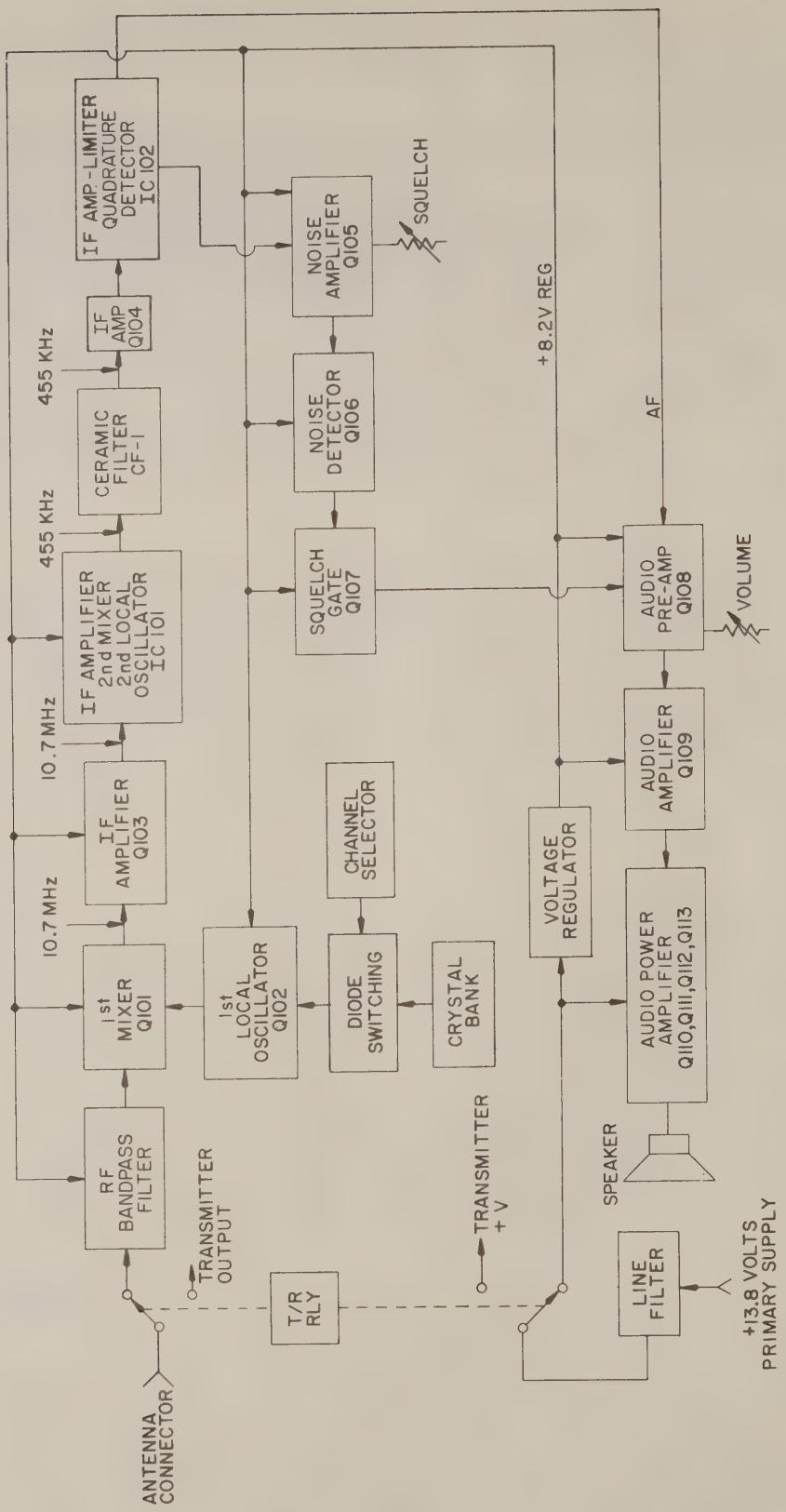
The Receiver board on the BTL-304 contains a diode switching matrix which enables the push button frequency select switch to remotely control the receive channel selected by switching a DC current only. When channel one is selected by depressing the F1 button on the front of the unit, SW1B applies a ground to R149, causing CR104 to conduct in the forward direction. Y101 is thus "switched in" through the low forward resistance of CR104. When SW1B is closed, interlocked switches SW2B through SW4B are open, causing CR105 through CR107 to be reverse biased. The high reverse resistance of these reverse biased diodes "switches out" their associated crystals. The transmitter crystals are directly switched by the "A" section of these switches (SW1A through SW4A).

2-4 LED DISPLAY BOARD

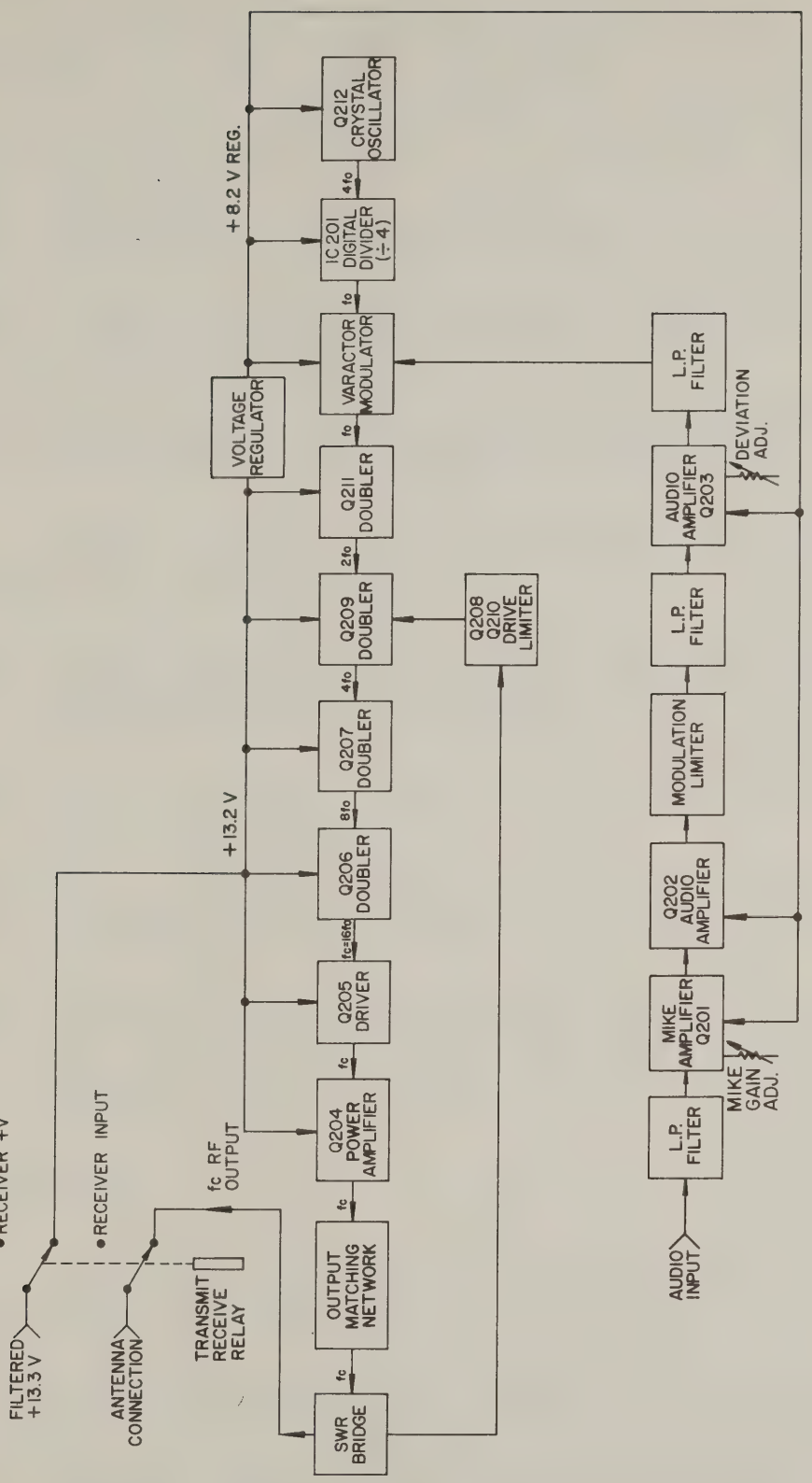
Channel Indicator (BTL-304): LD301 through LD304 function as channel indicators. When a channel selector switch button is depressed, the associated receive crystal switching contact closes, as explained in 2-2 above, grounding the cathode of the LED indicator for that channel. The LED then conducts current in the forward direction and emits a red glow. The other LED's whose switches

are open, are reverse biased and conduct no current.

Transmit & Power Indicators: The Power Indicator (BTL-301) and Transmit Indicator function similarly, except that the cathodes are grounded, and voltage to the LED's are provided, respectively, by the radio's primary power and the transmitter's supply voltage.



2-5 RECEIVER BLOCK DIAGRAM



2-6 TRANSMITTER BLOCK DIAGRAM

SECTION 3 ALIGNMENT AND TUNING PROCEDURES

3-1 EQUIPMENT REQUIRED–RECEIVER ALIGNMENT

3-1-1 FM Signal Generator
3-1-2 Oscilloscope
3-1-3 AC VTVM
3-1-4 Noise Generator (to be used in 3-5 only)

NOTE: During all steps of alignment, the squelch control should be in the clockwise position (minimum squelch action).

All transceivers should be aligned to the channel nearest the center of the frequency range over which they will operate.

Diagrams 4-1 and 4-2 show the location of all coils to be adjusted.

3-2 QUADRATURE DETECTOR ALIGNMENT

3-2-1 Connect the FM Signal Generator to the antenna input jack. Accurately set frequency to the center of the channel being used for alignment. Modulate Signal Generator with 1000 Hz, 3 KHz deviation.

3-2-2 Connect the oscilloscope to Test Point A, (Junction of C139, C140, R129). See diagram 4-2.

3-2-3 Adjust output of Signal Generator until all noise in scope pattern just disappears.

3-2-4 Adjust L108 for maximum peak to peak amplitude, while maintaining symmetry of the detected signal. When L103 is properly aligned, signal should be approximately 0.2 volts RMS with test signal input as noted in 3-2-1.

3-3 IF ALIGNMENT

3-3-1 Disconnect RF Signal Generator from antenna input.

3-3-2 Connect AC voltmeter across speaker terminals.

3-3-3 Adjust volume control for 0.5 volt noise reading on AC voltmeter.

3-3-4 Peak T102 (bottom core and top core, in that order) for maximum noise (maximum meter reading on AC voltmeter). If circuit is not badly misaligned, the correct point should be within 2 turns of the cores' present position.

NOTE: Coil will have two peaks; adjust core to peak away from the center of form.

3-3-5 Adjust volume control for 1.0 volt noise reading on AC voltmeter.

3-3-6 Connect the R.F. Signal Generator to the antenna input jack. Turn modulation off. Set the generator to the operating crystal frequency.

3-3-7 Adjust the Signal Generator output until the voltmeter reads 0.2 volts.

3-3-8 Adjust T101 (top core) and T101 (bottom core), for maximum quieting (lowest meter reading). Adjust Signal Generator to maintain reading on AC voltmeter between 0.1 and 0.2 volts. If two peaks occur, use the one away from the center of the coil form.

3-3-9 Set the generator frequency to the secondary image frequency. This is 910 KHz ABOVE the channel frequency.

NOTE: Some receivers may have the second oscillator at 11.155 MHz, if this is the case, the image frequency is 910 KHz BELOW the channel frequency. Check the frequency marked on top of the crystal (10.245 MHz for above and 11.155 MHz for below).

3-3-10 Adjust the Signal Generator output until voltmeter reads 0.2 volts.

3-3-11 Adjust T102 (bottom core), T102 (top core), T101 (bottom core) and T101 (top core) (in that order) for maximum quieting degradation (highest meter reading). Adjust Signal Generator output to maintian voltmeter reading between 0.1 and 0.2 volts. The correct position for the cores should be within two turns of the position in step No. 4 and 8.

3-4 RF (RECEIVER) ALIGNMENT

3-4-1 Pre-set L104 flush with top of coil form.

3-4-2 Connect AC voltmeter across the speaker terminals.

3-4-3 With nothing connected to the antenna input, adjust the volume control until AC voltmeter reads 1 volt of noise.

3-4-4 Connect Signal Generator to antenna input jack. Set generator accurately to the center frequency of the channel being used for alignment. Turn modulation off.

3-4-5 Adjust output of Signal Generator until AC voltmeter reads 0.2 volts.

3-4-6 Adjust L101, L102 and L103, in that order, for maximum quieting (lowest meter reading). Adjust Signal Generator output to maintain voltmeter reading between 0.1 and 0.2 volts. Repeat adjustments until no further improvement can be made. If two peaks occur on any core, use the peak with the core nearest the top of the coil form.

3-4-7 Adjust L104 for maximum quieting (lowest meter reading). Adjust Signal Generator to maintain reading on AC voltmeter between 0.1 and 0.2 volts. If two peaks occur, use the one away from center of the coil form.

3-5 NOISE BALANCE ADJUSTMENT

NOTE: This adjustment may be required only if excessive "ignition noise" is encountered. Usually, the noise problem is caused by improper or inadequate noise suppression of the vehicle's ignition system.

3-5-1 Using a "T" connector, connect the FM Signal Generator and the Noise Generator to the Antenna input jack. If a "T" connector is not available, connect the FM generator to the antenna jack and feed in the noise signal by means of a 3 or 4 turn loop coupled to the input coil, L101.

3-5-2 Connect the oscilloscope to the junction of Q112 emitter and Q113 collector, or to the speaker terminals.

3-5-3 Apply a 3 to 10 microvolt signal, as accurately as can be set to the exact channel frequency (carrier only, no modulation), and adjust the output of the noise generator until spikes are clearly seen in the audio output as viewed on the oscilloscope. The noise spikes will be either mostly positive or negative if an unbalanced condition exsists.

3-5-4 Tune L108 (Quadrature Detector Coil) until the noise spikes are equally positive and negative in their amplitude. The overall amplitude of these spikes should be much less as a balance is achieved. Usually, only a 1/4 turn, or less, is needed to obtain the proper adjustment for best noise balance. If a proper balance can not be achieved, repeat the IF and RF alignments and then try the noise balance adjustment again.

3-6 EQUIPMENT REQUIRED–TRANSMITTER ALIGNMENT

3-6-1 RF Wattmeter (or any equivalent device which provides a 50 ohm load at the appropriate power range).

3-6-2 Frequency Counter – 50 MHz required.

3-6-3 FM Modulation Meter – Lampkin 205A or equivalent peak reading deviation meter.

3-6-4 Audio Generator – HP 200D or equivalent.

3-6-5 VTVM (See 3-7-4 below).

3-6-6 Oscilloscope

3-7 TRANSMITTER TUNING PROCEDURE

NOTE: The encircled numbers on diagram 4-7 correspond to the last digit in the following procedure steps. The unit must be connected to a suitable 50Ω load for proper alignment of the final transmitter stage.

3-7-1 Install crystals. For full bandwidth alignment, a center tune-up crystal must be used. Alignment is done on the center tune-up frequency and then the bandwidth is checked using the high and low crystals. The total maximum bandwidth for Transmitter operation is 1.0 MHz (500 KHz above and 500 KHz below the tune-up frequency).

Because of the extremely wide frequency range over which this transmitter is required to operate (29-50 MHz), it has been necessary to divide the frequency band into seven sub-bands, each 3 MHz wide. Each sub-band has its own set of tuning capacitors, which are listed in a table on the schematic diagram. The table also shows the change in L202 and L206 between the high and low portions of the band.

By dividing the band into seven small segments instead of the usual two or three large ones, it has been possible to provide the tuned circuits with the correct L-to-C ratio and circuit "Q" for optimum operation at all frequencies. In this manner the compromises necessary to achieve wide tuning range have been eliminated.

3-7-2 Tighten trimmer capacitors C217 and C218 to maximum clockwise position (maximum capacitance).

3-7-3 Loosen trimmer capacitor C252 to near minimum capacitance (counter-clockwise).

The adjustment of C252 need only be made once and is not affected by the other adjustments in the Output Matching Network, nor by changing to another frequency in the sub-band. Consequently, if the transmitter has ever been aligned before, it will not be necessary to re-adjust C252 and all steps pertaining to this adjustment in the following paragraphs should be omitted. This adjustment is normally made at the factory near the center of the sub-band and then sealed.

3-7-4 Set warping capacitors C246, C248, C250 and C252 to mid-range capacitance (1/2 open).

In the following procedure, key the transmitter momentarily, while each adjustment is being made. Do not leave in a continuously keyed state until alignment is complete.

Required equipments are a 50 ohm resistive load termination rated at 50 watts or more, an RF wattmeter, and a VTVM in which the reference (ground or common) lead can be "floated" above ground (a Battery Powered unit or an AC Powered unit with the "common" isolated from chassis ground).

3-7-5 Oscillator Check

a. Connect the probe of the VTVM to the Emitter of Q212 (common connected to ground).

b. If the oscillator is running, the voltage at this point will be about 1.7 VDC. If it is not running, the voltage will be about 1.3 VDC.

3-7-6 Modulator Alignment

a. Connect the common lead of the VTVM to the A+ buss in the transmitter (Junction of R237, R231, etc.).

b. Connect the probe of the VTVM to the junction of R237 and T206. Short this point to the collector of Q211 with a jumper.

c. Tune the core of L206 for peak on the VTVM (maximum voltage drop across R237). Normal voltage is -0.8 volts.

d. Remove the jumper.

3-7-7 T206: The common lead of the VTVM is left connected to the A+ buss during the remainder of the alignment. Before proceeding, back all of the bottom cores of transformers T202 through T206 until the cores are flush with the bottom of the P.C. board. Connect the VTVM probe to the junction of R231 and T205. Connect a jumper between this point and the collector of Q209. Tune the primary (top core) of T206 for a peak reading on the VTVM (max. voltage drop across R231), and then adjust the bottom core of T206 for a peak reading. Normal voltage is -1.8 volts. Remove the jumper. In adjusting T203 through T206, the secondary (top core) is first peaked with the primary (bottom core) backed out of its winding, and then the primary is tuned. The secondary is not to be readjusted after the primary is tuned.

3-7-8 T205: Connect the VTVM probe to the junction of R225 and T204. Jumper this point to the collector of Q207. Adjust the secondary core and then the primary core for a peak reading on the VTVM as in 5a. above. Remove the jumper. Normal voltage is -3.5 volts.

3-7-9 T204: Connect the VTVM probe to the junction of R223 and T203. Jumper this point to the collector of Q206. Adjust the secondary core and then the primary core for a peak reading as in 5a. above. Remove the jumper. Normal voltage is -1.2 volts.

3-7-10 T203: Connect the VTVM probe to the junction of R220 and T302. Jumper this point to the collector of Q205. Adjust the secondary and primary cores of T203 as in 5a. above, then remove the jumper. Normal voltage is -1.0 volts.

3-7-11 T202: Adjust the primary (bottom core) of T202 for a dip in the reading of the VTVM. Then adjust both primary and secondary cores for maximum RF power output as indicated on the voltmeter.

3-7-12 Power Amplifier Alignment

a. The following adjustments are peaked in the order listed for maximum power output as indicated on the R.F. wattmeter.

1.) C218
2.) C217
3.) T202, primary & secondary
4.) Repeat the above three steps until no further improvement is noted.

b. Second Harmonic Trap Adjustment: C252 is adjusted for minimum second harmonic output as observed by a spectrum analyzer or other means. Repeak C217 and C218 for maximum power out. Repeat these three steps until no further improvement is noted. Once aligned at one frequency, the second harmonic trap need not be re-aligned for other frequencies within the same sub-band.

c. Check power output on all the crystals installed in the BTL-304. Adjust T202 for the best compromise in RF power output between the highest and lowest channels. Minimum rated power output is 30 watts at a 13.8 VDC.

d. It is desirable, during Power Amplifier Alignment, to place the unit, especially the transmitter section, on a sheet of steel to simulate the presence of the unit's cover. This sheet should be large enough so that it completely covers the bottom of the transmitter board and protrudes beyond the chassis on both sides. Do not permit this sheet to touch any part protruding below the transmitter board.

3-8 CRYSTAL NETTING PROCEDURE

NOTE: The following procedures must be performed with the radio set at a temperature of 70 to 80°F. The frequency of each channel must be set to within ±.0001% of the assigned channel frequency.

3-8-1 Connect the unit to the RF wattmeter or dummy load.

3-8-2 Turn transmitter on (key the mike's PTT switch or ground pin No. 1 of J2).

3-8-3 Place an RF pick-up loop consisting of 3 or 4 turns near the final transistor's output circuit (near L201; See diagram 4-5).

3-8-4 Read the frequency on the counter.

3-8-5 Adjust the appropriate netting capacitor (C246 through C252; See diagram 4-9 for their location) until the frequency being read on the counter is "on" channel.

3-9 DEVIATION AND MIKE GAIN ADJUSTMENT

3-9-1 Use the following procedure for proper adjustment of the Mike Gain (R204) and Deviation (R216) control (See diagram 4-9 for their location):

a. Connect the unit to the RF wattmeter or dummy load.

b. Connect the scope probe to the junction of R211 and CR201. See 4-5 for location. It may be more convenient to connect the probe to the cathode lead of CR202.

c. Key the transmitter and talk into the microphone with a normal voice level. Observe the waveform on the scope and adjust R204 (Mike Gain) until approximately 10% of the voice peaks are clipped.

d. Connect the audio generator to the mike input terminals. Set the audio voltage level to 0.5 - 1.0 volts RMS at 400 Hz.

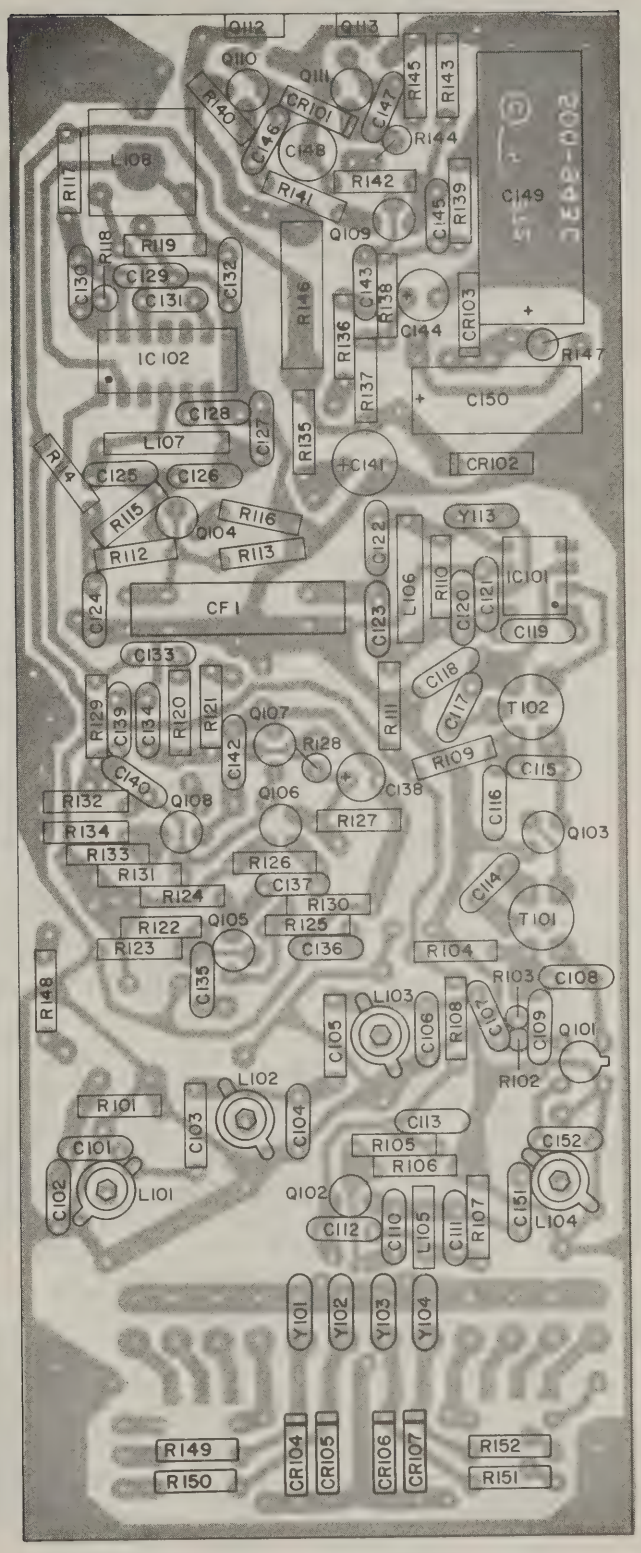
e. Couple the FM Modulation Meter's RF pick up to the transmitter.

f. Key the transmitter and adjust R216 (Deviation Control) so that the maximum deviation is no greater than ±5 KHz.

g. Reduce the audio input level to 0.25 volts RMS. The deviation should not be greater than ±5 KHz.

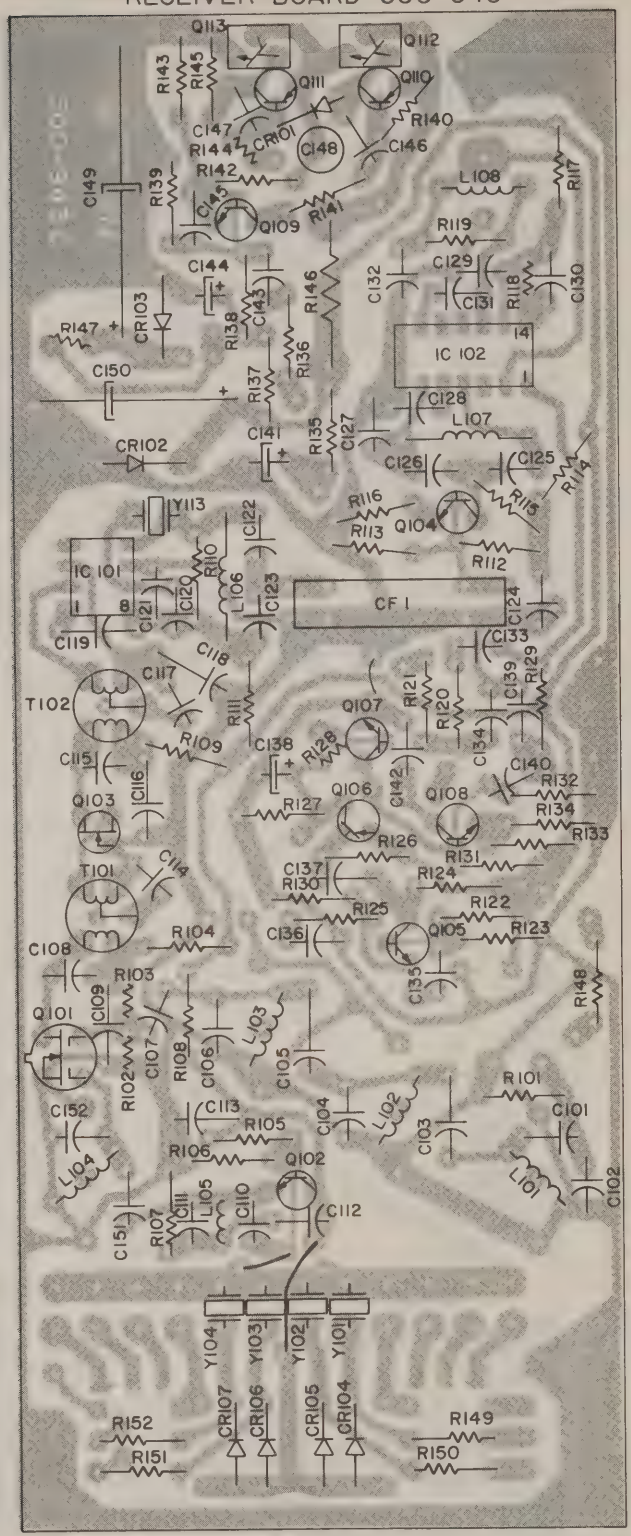
SECTION 4 DIAGRAMS, VOLTAGE DATA AND SCHEMATICS

RECEIVER BOARD 500-943

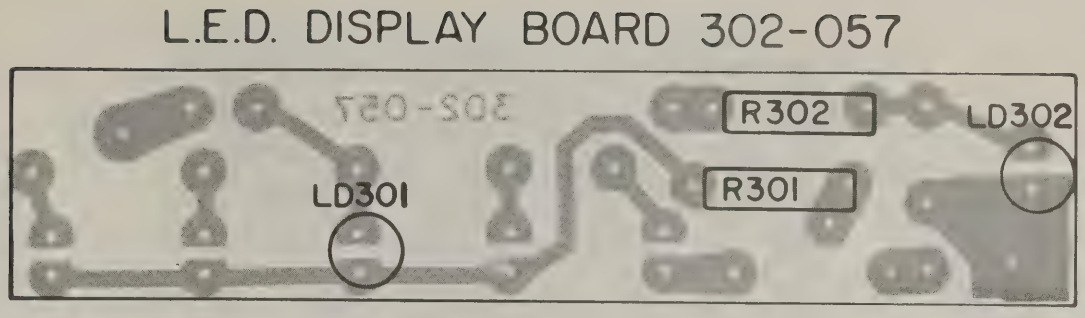


4-1 RECEIVER BOARD PARTS PLACEMENT DIAGRAM

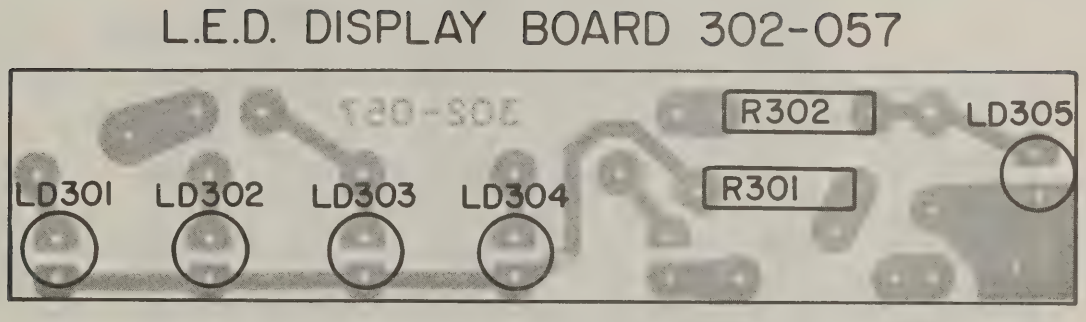
RECEIVER BOARD 500-943



4-2 RECEIVER BOARD BOTTOM VIEW

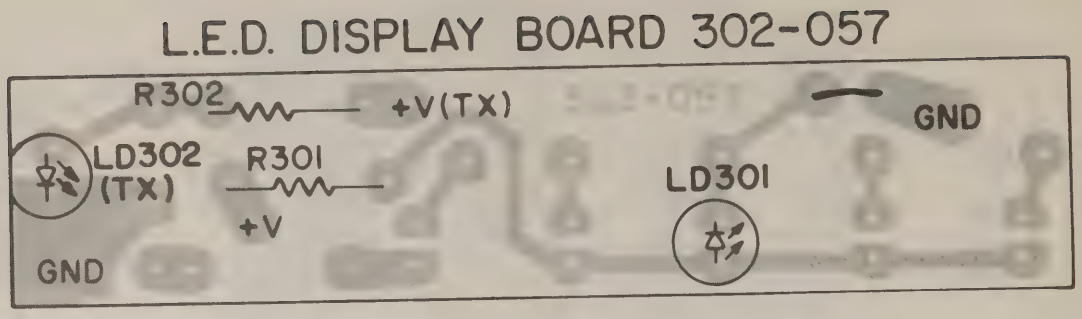


BTL-301

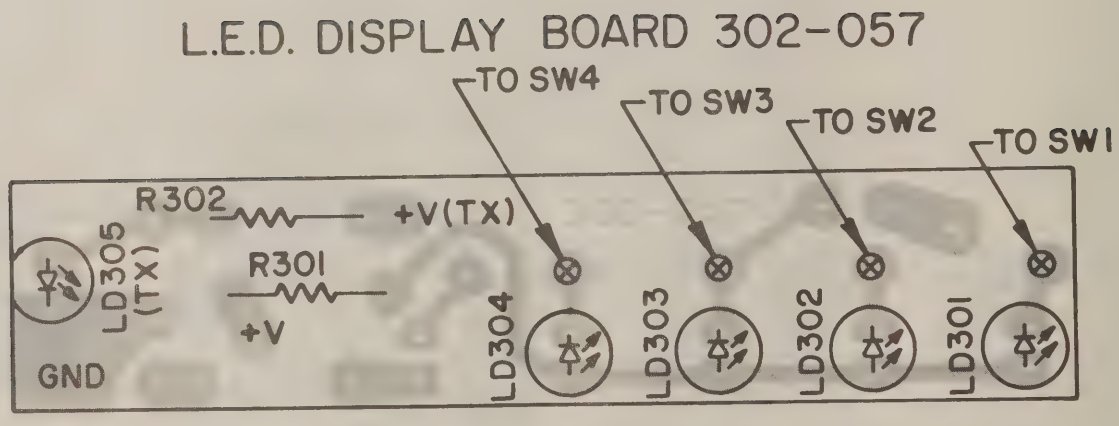


BTL-304

4-3 LED DISPLAY BOARDS PARTS PLACEMENT DIAGRAMS



BTL-301



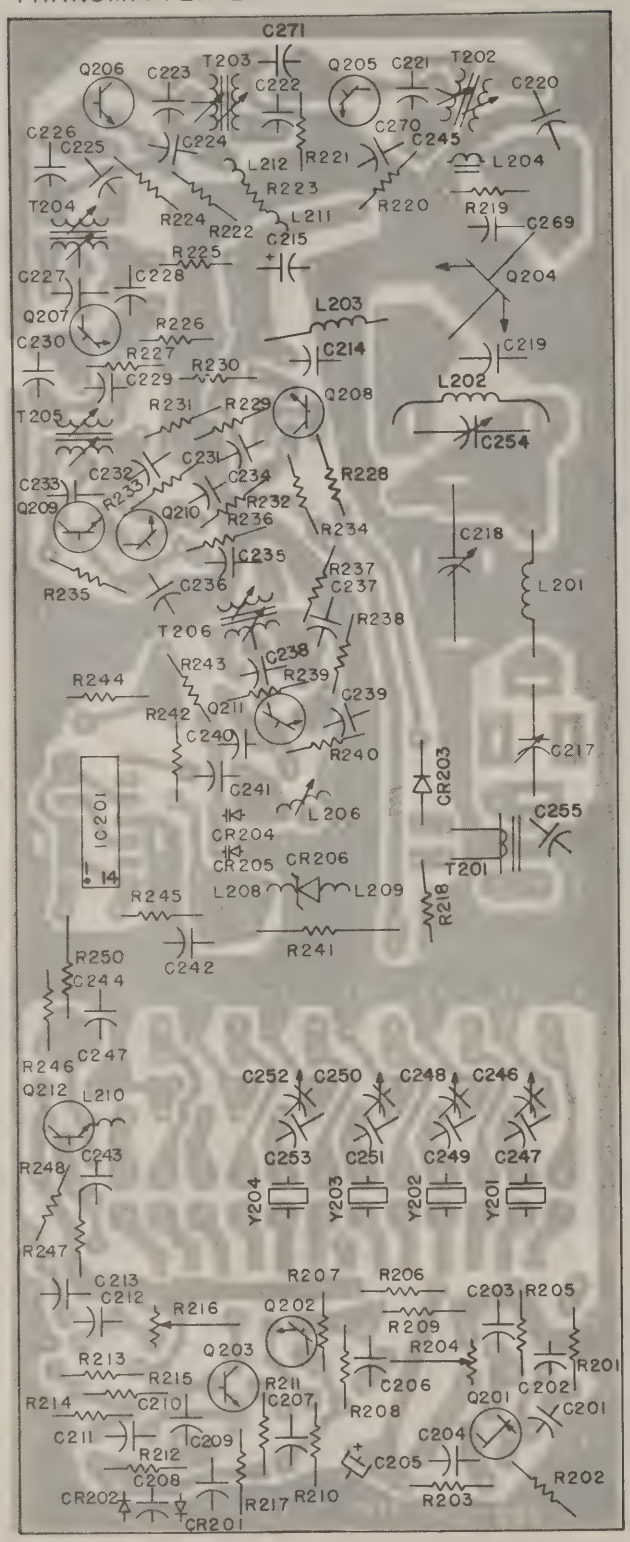
BTL-304

4-4 LED DISPLAY BOARDS BOTTOM VIEWS

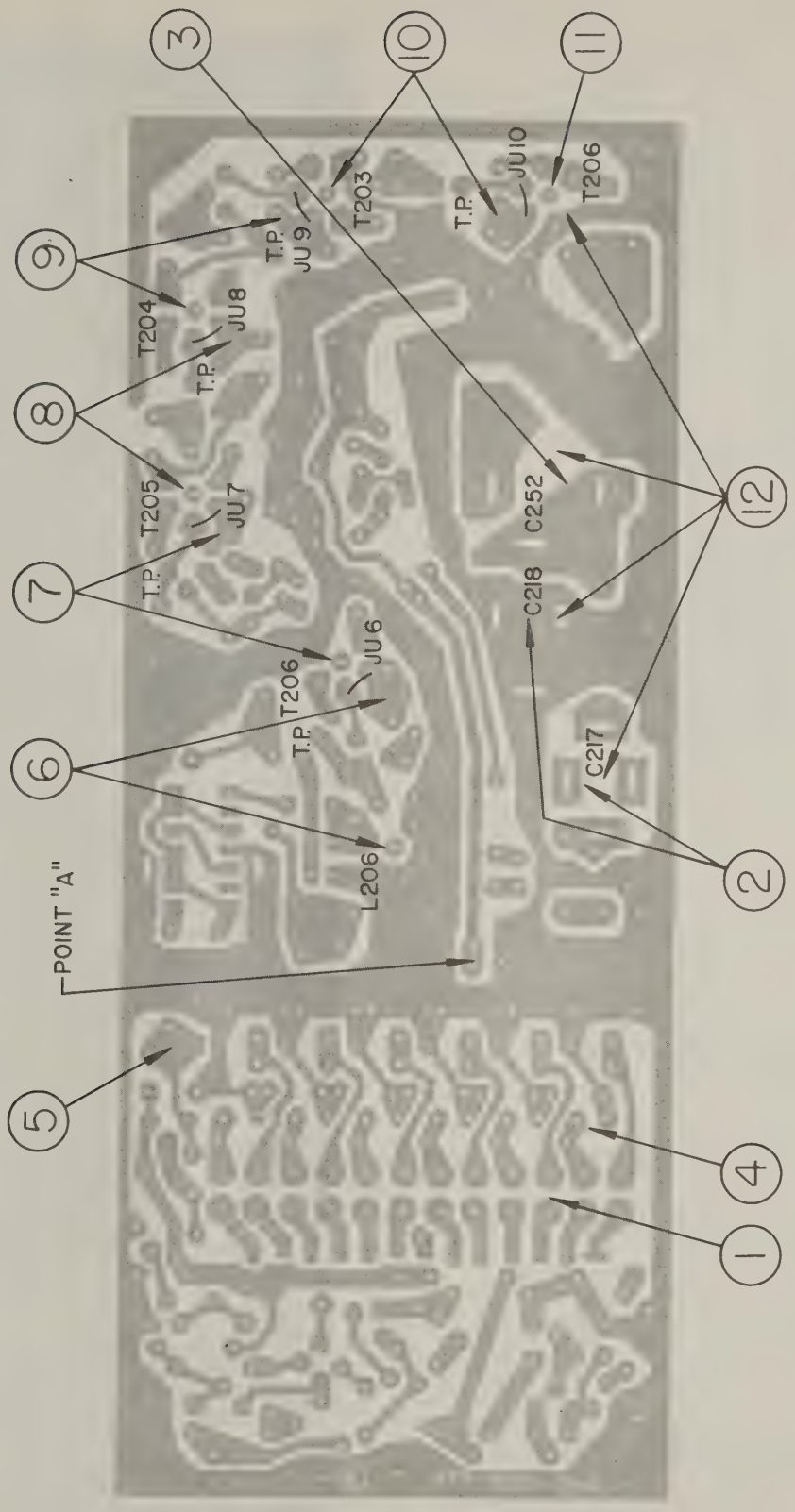
TRANSMITTER BOARD 500-996

4-5 TRANSMITTER BOARD PARTS PLACEMENT DIAGRAM

TRANSMITTER BOARD 500-996



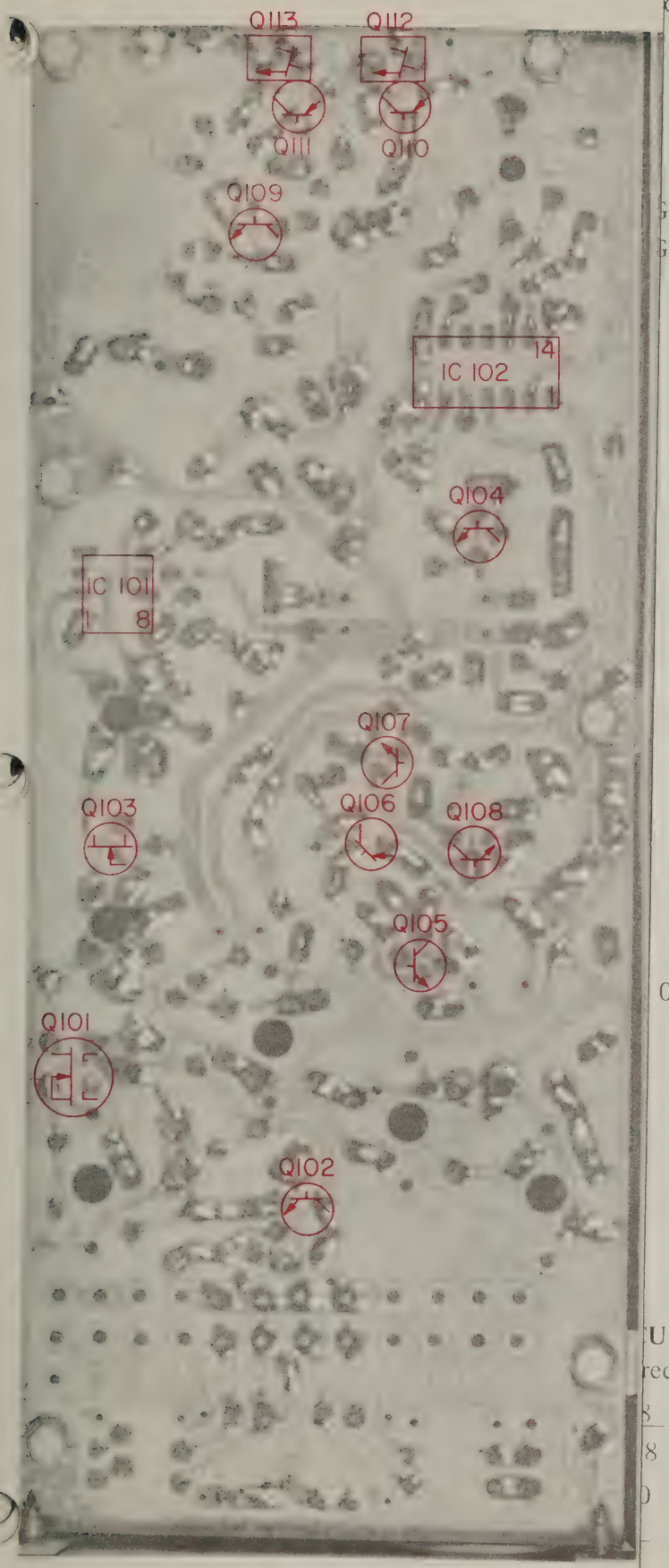
4-6 TRANSMITTER BOARD BOTTOM VIEW



4-7 TRANSMITTER BOARD TUNE-UP TEST POINTS

OR LOCATION DIAGRAM

sure with a VTVM.
o the power cable



	Base (Gate)	Collector (Drain)
	G1: 0	4.5
	G2: 0.8	
	4.4	7.8
	0	6.8
	1.1	4.5
	1.7	4.8
	8.2	0 (unsquelched)
	8.2	1.0 (squelched)
	8.2	1.5 min. (tight squelch)
	0	1.9 (unsquelched)
	0.80	0.30 (squelched)
	0.80	0.10 (tight squelch)
	1.9	5.1 (unsquelched)
	0.10	8.2 (tight squelch)
	1.3	12.4
	13.2	7.4
	6.6	0.10
	7.4	13.8
	0.10	6.8
	0	5
	0.5	4.6
	0.65-0.90	6.0* (Varies with setting of R216)
	0	13.0
	-0.2	11.3
	-0.05	12.1
	-0.9	11.3
	0.2	1.0
	-0.5	11.1
	0.9	0.2
	1.0	12.4
	–	8.2

UITS

receiver Board, 500-943; IC201 is located on the TX Board

8	9	10	11	12	13	14
8				–	–	
0	0.2	1.4	2.9	3.5	7.6	5.0
–	–	5.0	0	–	–	5.0

4-8 VOLTAGE DATA AND SEMI-CONDUCTOR LOCATION DIAGRAM

NOTE: All voltages are nominal and are measure with a VTVM. 13.8 VDC Supply Voltage at input to the power cable supplied with the unit.

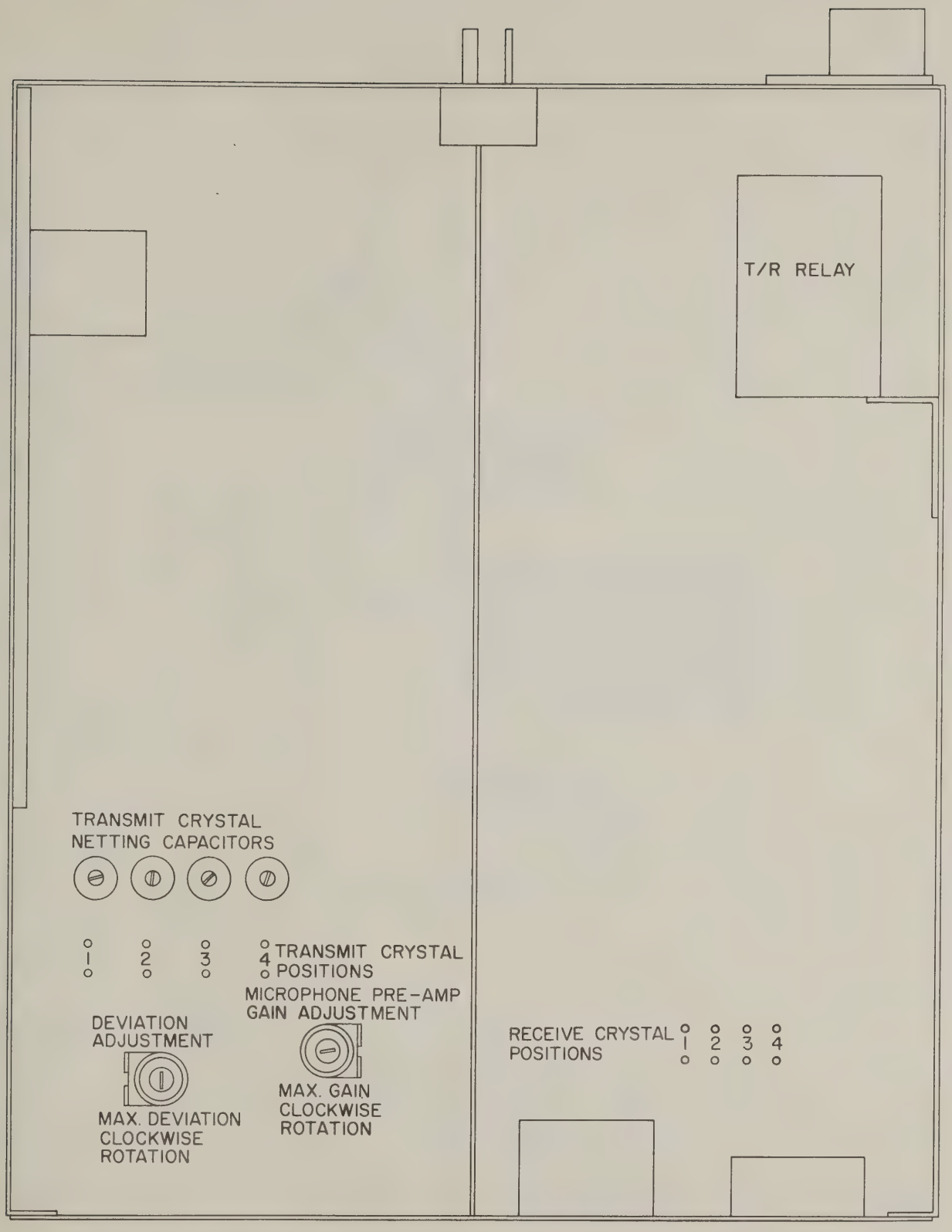
VOLTAGE DATA – TRANSISTORS

	Transistor	Emitter (Source)	Base (Gate)	Collector (Drain)
Receiver Board No. 500-943	Q101(FET)	0	G1: 0 G2: 0.8	4.5
	Q102	3.8	4.4	7.8
	Q103(FET)	0	0	6.8
	Q104	0.4	1.1	4.5
	Q105	1.0	1.7	4.8
	Q106(PNP)	8.2	8.2	0 (unsquelched)
		8.2	8.2	1.0 (squelched)
		8.2	8.2	1.5 min. (tight squelch)
	Q107	0	0	1.9 (unsquelched)
		0	0.80	0.30 (squelched)
		0	0.80	0.10 (tight squelch)
	Q108	1.4	1.9	5.1 (unsquelched)
		1.1	0.10	8.2 (tight squelch)
	Q109	0.7	1.3	12.4
	Q110(PNP)	13.8	13.2	7.4
	Q111(PNP)	6.8	6.6	0.10
	Q112	6.8	7.4	13.8
	Q113	0	0.10	6.8
TX BOARD 500-996				
	Q201(FET)	0.8	0	5
	Q202	0.2	0.5	4.6
	Q203	0.15-0.30	0.65-0.90	6.0* (Varies with setting of R216)
	Q204	0	0	13.0
	Q205	0	-0.2	11.3
	Q206	0.9	-0.05	12.1
	Q207	1.0	-0.9	11.3
	Q208	0	0.2	1.0
	Q209	0.2	-0.5	11.1
	Q210	0.2	0.9	0.2
	Q211	0.9	1.0	12.4
	Q212	1.7	–	8.2

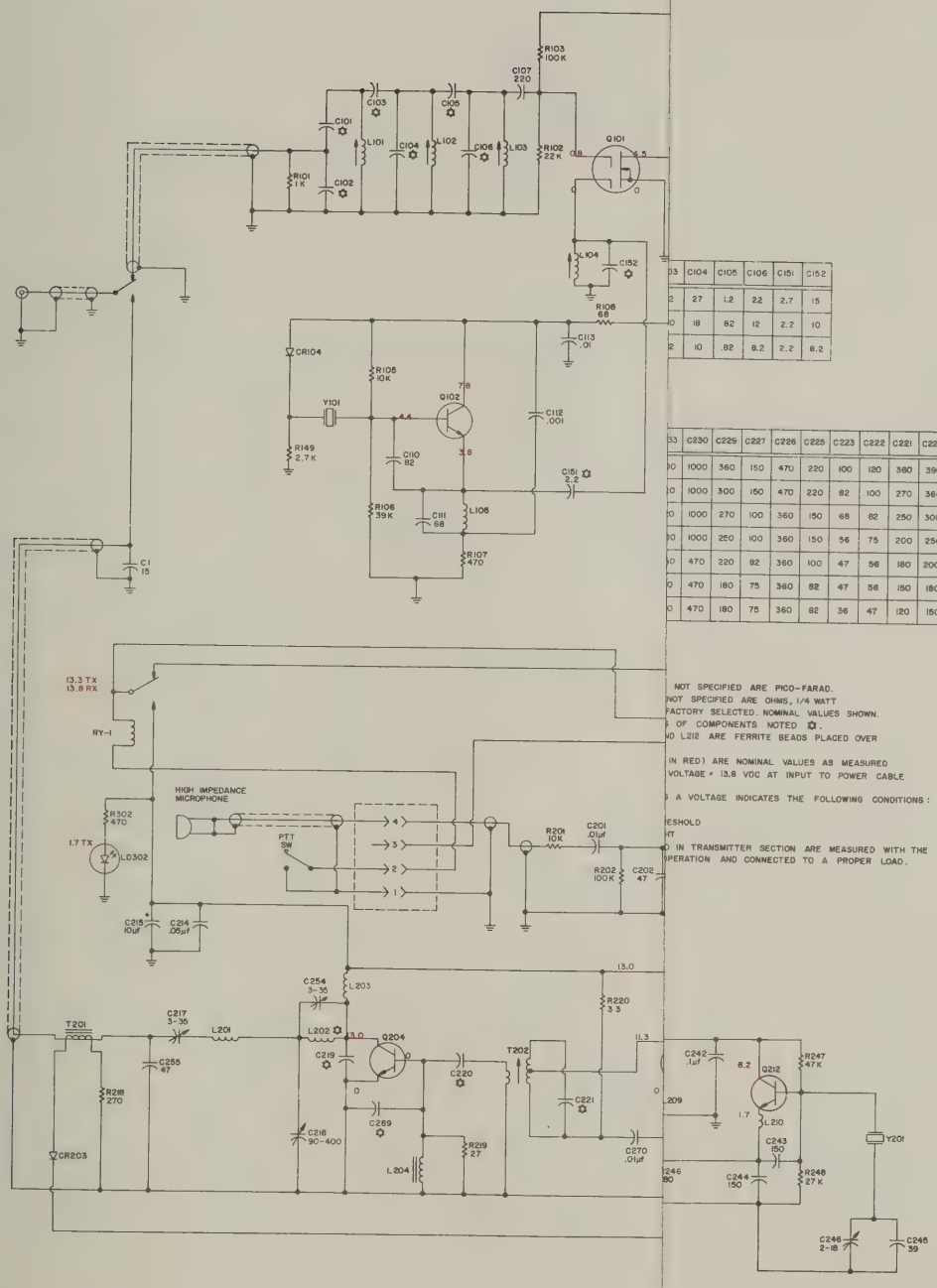
VOLTAGE DATA–INTEGRATED CIRCUITS

NOTE: IC1014 IC102 are located on the receiver Board, 500-943; IC201 is located on the TX Board

IC. No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
IC 101	4.2	0.7	0.7	4.2	7.8	0	4.2	7.8	–	–	–	–	–	–
IC 102	4.0	3.5	0	1.3	1.3	1.3	0	0	0.2	1.4	2.9	3.5	7.6	5.0
IC 201	5.0	5.0	5.0	5.0	–	5.0	5.0	–	–	5.0	0	–	–	5.0



4-9 CRYSTAL LOCATION AND ADJUSTMENT DIAGRAM



C103	C104	C105	C106	C151	C152
2	27	1.2	22	2.7	15
0	18	8.2	12	2.2	10
2	10	8.2	8.2	2.2	8.2

C233	C230	C229	C227	C226	C225	C223	C222	C221	C220	C219	C269	L206	L202
00	1000	360	150	470	220	100	120	360	390	220	820	301-892	302-086
10	1000	300	150	470	220	82	100	270	360	220	820	301-892	302-086
00	1000	270	100	360	150	68	82	250	300	220	820	301-892	302-086
00	1000	250	100	360	150	56	75	200	250	220	470	301-892	302-086
50	470	220	82	360	100	47	56	180	200	82	470	302-083	102-742
0	470	180	75	360	82	47	56	150	180	82	470	302-083	102-742
0	470	180	75	360	82	36	47	120	150	82	470	302-083	102-742

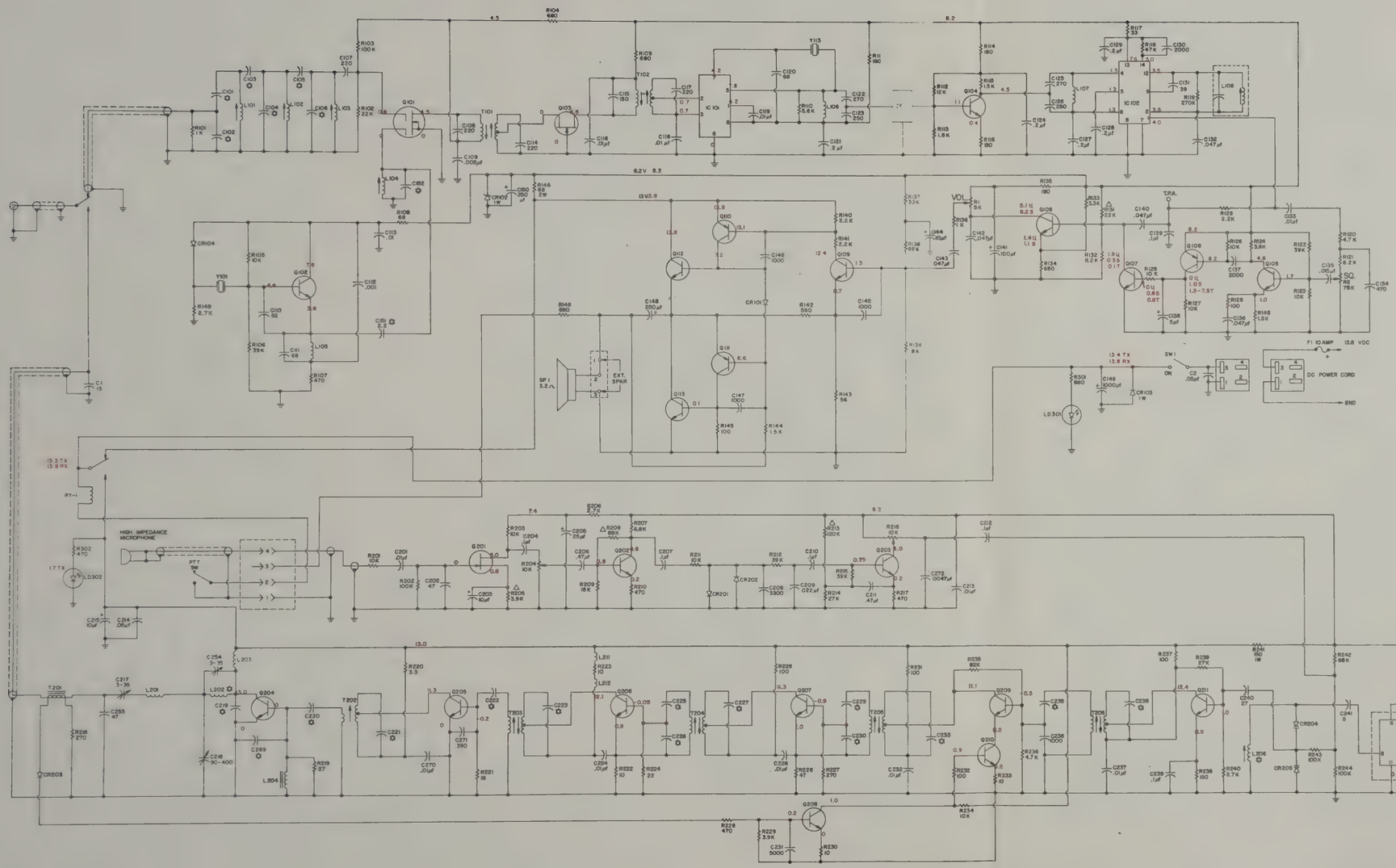
NOT SPECIFIED ARE PICO-FARAD.
NOT SPECIFIED ARE OHMS, 1/4 WATT
FACTORY SELECTED. NOMINAL VALUES SHOWN.
OF COMPONENTS NOTED ✡.
ND L212 ARE FERRITE BEADS PLACED OVER

IN RED) ARE NOMINAL VALUES AS MEASURED
VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE

A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:

ESHOLD
HT
IN TRANSMITTER SECTION ARE MEASURED WITH THE
PERATION AND CONNECTED TO A PROPER LOAD.

MATIC WITH VOLTAGES (BTL-301)



RECEIVER

FREQUENCY	C101	C102	C103	C104	C105	C106	C151	C152
30-36 MHZ	33	300	1.2	27	1.2	2.2	2.7	15
36-44MHZ	22	220	1.0	18	.82	12	2.2	10
44-50MHZ	15	150	.82	10	.82	8.2	2.2	8.2

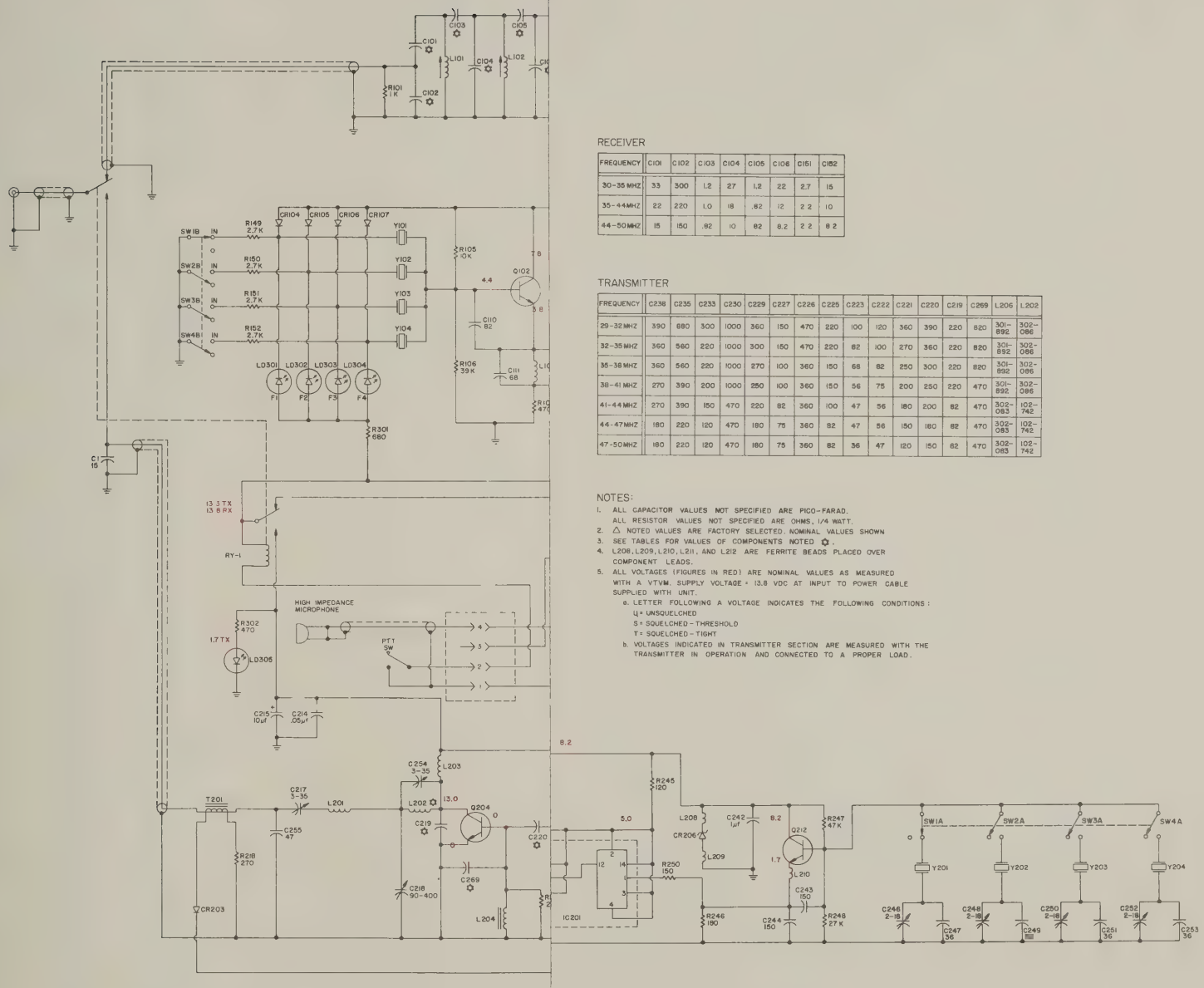
TRANSMITTER

FREQUENCY	C238	C236	C233	C230	C229	C227	C226	C225	C223	C222	C221	C220	C219	C269	L206	L202
29-32 MHZ	390	680	300	1000	360	150	470	220	100	130	360	390	220	620	302-892	302-086
32-36 MHZ	360	560	220	1000	300	150	470	220	82	100	270	360	220	620	301-892	302-086
36-38 MHZ	360	560	220	1000	270	100	360	150	68	82	250	300	220	620	301-892	302-086
38-41 MHZ	270	390	200	1000	250	100	360	150	56	75	200	250	220	470	301-892	302-086
41-44 MHZ	270	390	150	470	220	82	360	100	47	56	180	200	82	470	302-083	102-742
44-47 MHZ	180	220	120	470	180	75	360	82	47	56	150	180	82	470	302-083	102-742
47-50 MHZ	180	220	120	470	180	75	360	82	36	47	120	150	82	470	302-083	102-742

NOTES:

1. ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD. ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT.
2. △ NOTED VALUES ARE FACTORY SELECTED. NOMINAL VALUES SHOWN
3. SEE TABLES FOR VALUES OF COMPONENTS NOTED ☆.
4. L208, L209, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER COMPONENT LEADS.
5. ALL VOLTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED WITH A VTVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE SUPPLIED WITH UNIT.
   a. LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
      U = UNSQUELCHED
      S = SQUELCHED - THRESHOLD
      T = SQUELCHED - TIGHT
   b. VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.

4-10 SCHEMATIC WITH VOLTAGES (BTL-301)



RECEIVER

FREQUENCY	C101	C102	C103	C104	C105	C106	C151	C152
30-35 MHZ	33	300	1.2	27	1.2	22	2.7	15
35-44 MHZ	22	220	1.0	18	.82	12	2.2	10
44-50 MHZ	15	150	.82	10	82	8.2	2.2	8.2

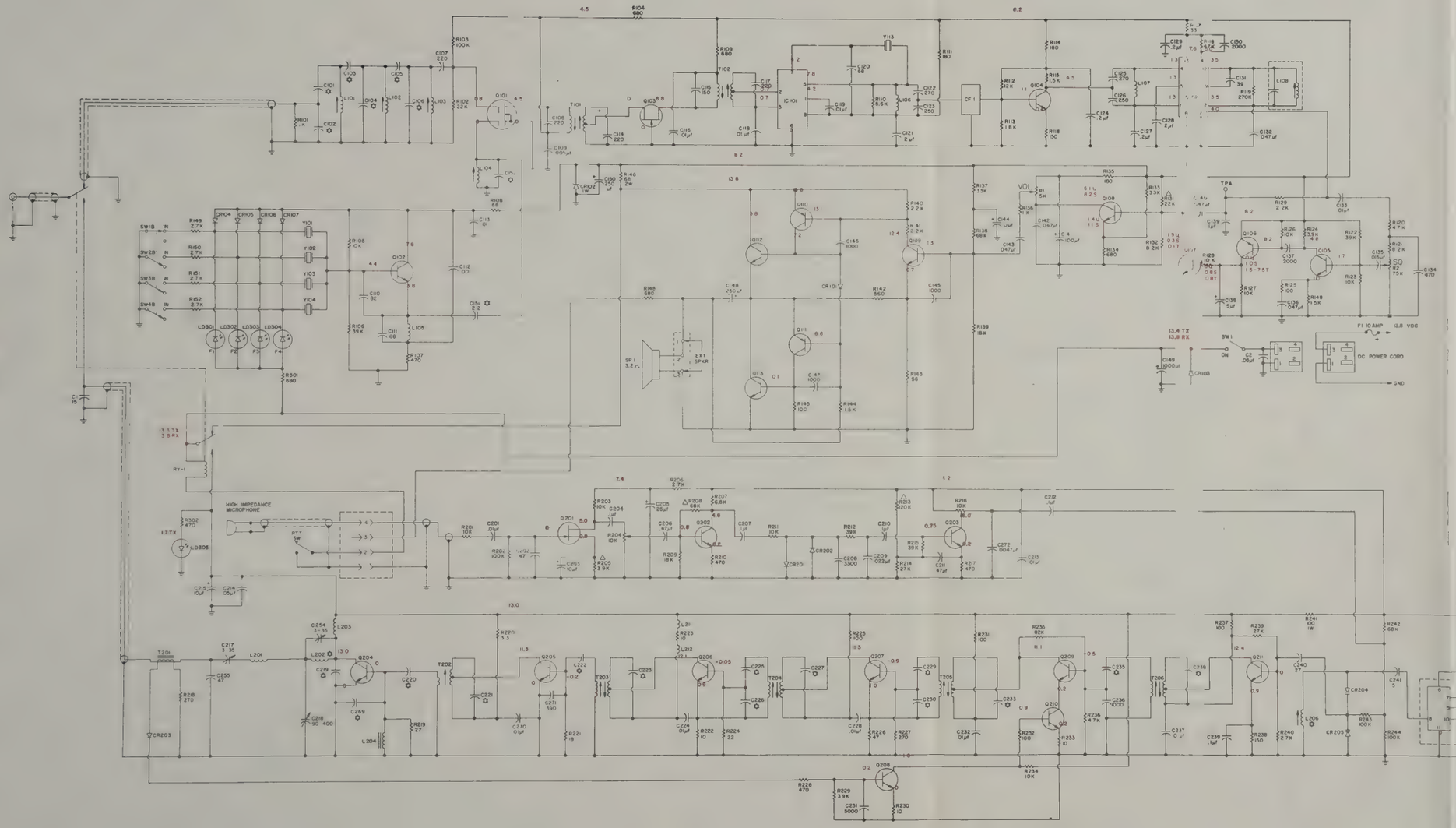
TRANSMITTER

FREQUENCY	C238	C235	C233	C230	C229	C227	C226	C225	C223	C222	C221	C220	C219	C269	L206	L202
29-32 MHZ	390	680	300	1000	360	150	470	220	100	120	360	390	220	820	301-892	302-086
32-35 MHZ	360	560	220	1000	300	150	470	220	82	100	270	360	220	820	301-892	302-086
35-38 MHZ	360	560	220	1000	270	100	360	150	68	82	250	300	220	820	301-892	302-086
38-41 MHZ	270	390	200	1000	250	100	360	150	56	75	200	250	220	470	301-892	302-086
41-44 MHZ	270	390	150	470	220	82	360	100	47	56	180	200	82	470	302-083	102-742
44-47 MHZ	180	220	120	470	180	75	360	82	47	56	150	180	82	470	302-083	102-742
47-50 MHZ	180	220	120	470	180	75	360	82	36	47	120	150	62	470	302-083	102-742

NOTES:

1. ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD.
   ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT.
2. △ NOTED VALUES ARE FACTORY SELECTED. NOMINAL VALUES SHOWN
3. SEE TABLES FOR VALUES OF COMPONENTS NOTED ✡.
4. L208, L209, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER COMPONENT LEADS.
5. ALL VOLTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED WITH A VTVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE SUPPLIED WITH UNIT.
   a. LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
      U = UNSQUELCHED
      S = SQUELCHED - THRESHOLD
      T = SQUELCHED - TIGHT
   b. VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.

4-11 SCHEMATIC WITH VOLTAGES (BLT-304)



RECEIVER

FREQUENCY	C101	C102	C103	C104	C105	C106	C151	C152
30-35 MHZ	33	300	1.2	27	1.2	22	2.7	15
35-44 MHZ	22	220	1.0	18	82	12	2.2	10
44-50 MHZ	15	150	.82	10	82	8.2	2.2	8.2

TRANSMITTER

FREQUENCY	C238	C236	C233	C230	C229	C227	C226	C225	C223	C222	C221	C220	C219	C269	L206	L202
29-32 MHZ	390	680	300	1000	160	50	470	220	100	20	166	390	220	680	30-892	302-086
32-36 MHZ	360	560	220	1000	100	150	470	220	82	100	270	360	220	820	30-892	302-086
35-38 MHZ	360	560	220	1000	270	100	160	150	68	82	250	100	220	820	30-892	302-086
38-41 MHZ	270	390	200	1000	250	100	160	150	56	75	200	250	220	470	30-892	302-086
41-44 MHZ	270	390	150	470	220	82	360	100	47	56	180	200	82	470	302-083	028-742
44-47 MHZ	180	220	120	470	180	75	360	82	47	56	150	180	82	470	302-083	028-742
47-50 MHZ	180	220	120	470	180	75	360	82	36	47	120	150	82	470	302-083	028-742

NOTES

1. ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD
   ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT
2. △ NOTED VALUES ARE FACTORY SELECTED NOMINAL VALUES SHOWN
3. SEE TABLES FOR VALUES OF COMPONENTS NOTED ✪.
4. L208, L209, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER COMPONENT LEADS.
5. ALL VOLTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED WITH A VTVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE SUPPLIED WITH UNIT.
   a. LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
      U = UNSQUELCHED
      S = SQUELCHED - THRESHOLD
      T = SQUELCHED - TIGHT
   b. VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.

4-11 SCHEMATIC WITH VOLTAGES (BLT-304)

SECTION 5 PARTS LIST
5-1 RECEIVER BOARD 500-943

RESISTORS

All Resistors are ±10%, ¼W, unless otherwise noted.

Item	Description	Part No.
R101	1K	
R102	22K	
R103	100K	
R104	680 ohm	
R105	10K	
R106	39K	
R107	470 ohm	
R108	330 ohm	
R109	680 ohm	
R110	5.6K	
R111	180 ohm	
R112	12K	
R113	1.8K	
R114	180 ohm	
R115	1.5K	
R116	150 ohm	
R117	33 ohm	
R118	47K	
R119	270K	
R120	4.7K	
R121	8.2K	
R122	39K	
R123	10K	
R124	3.9K	
R125	100 ohm	
R126	10K	
R127	10K	
R128	10K	
R129	2.2K	
R130	1.5K	
R131	22K	
R132	8.2K	
R133	3.3K	
R134	680 ohm	
R135	180 ohm	
R136	1K	
R137	33K	
R138	68K	
R139	18K	
R140	2.2K	
R141	2.2K	
R142	560 ohm	
R143	56 ohm	
R144	1.5K	
R145	100 ohm	
R146	68 ohm, 2W, 5%	
R148	680 ohm	

CAPACITORS

Item	Description	Part No.
C101	*	
C102	*	
C103	*	
C104	*	
C105	*	
C106	*	
C107	220pf, 5%, 50V (Mica)	1506-0221-550
C108	Same as C107	
C109	.005mf, +80 -20%, 500V Z5U (Disc)	1503-0502-001
C110	82pf, 5%, 50V (Mica)	1506-0820-550
C111	68pf, 5%, 50V (Mica)	1506-0680-550
C112	.001mf, +80 -20%, 500V Z5U (Disc.)	1503-0102-001
C113	.01mf, +80 -20%, 500V Z5U (Disc.)	1503-0103-001
C114	220pf, 5%, 50V (Mica)	1506-0221-550
C115	150pf, 5%, 50V (Mica)	1506-0151-550
C116	.01mf, +80 -20%, 500V Z5U (Disc.)	1503-0103-001
C117	220pf, 5%, 50V (Mica)	1506-0221-550
C118	.01mf, +80 -20%, 500V Z5U (Disc.)	1503-0103-001
C119	Same as C118	
C120	68pf, 5%, 50V (Mica)	1506-0680-550
C121	.2mf, +80 -20%, 12V (Disc.)	1501-0204-006
C122	270pf, 5%, 50V (Mica)	1506-0271-550
C123	250pf, 5%, 50V (Mica)	1506-0251-550
C124	.2mf, +80 -20%, 12V (Disc.)	1502-0204-006
C125	270pf, 5%, 50V (Mica)	1506-0271-550
C126	250pf, 5%, 50V (Mica)	1506-0251-550
C127	.2mf, +80 -20%, 12V (Disc.)	1502-0204-006
C128	Same as C127	
C129	Same as C127	
C130	.002mf, 20%, 500V Z5U (Disc.)	1523-0202-001
C131	39pf, 10%, NPO, 500V	1500-0390-605
C132	.047mf, 10%, 100V (Mylar Film)	1508-0473-610
C133	.01mf, 10%, 100V (Mylar Film)	1508-0103-610
C134	470pf, 20%, 500V Z5U (Disc.)	1523-0471-001
C135	.015mf, 10%, 100V (Mylar Film)	1508-0153-610
C136	.047mf, 10%, 100V (Mylar Film)	1508-0473-610
C137	.002mf, 20%, 500V Z5U (Disc.)	1523-0202-001
C138	5mf, 85°C, 50V, (Electrolytic)	1513-0050-004
C139	.1mf, 20%, 12V (Disc.)	1502-0104-005
C140	.047mf, 10%, 100V (Mylar Film)	1508-0473-610
C141	100mf, 85°C, 10V (Electrolytic)	1513-0101-001
C142	.047mf, 10%, 100V (Mylar Film)	1508-0473-610
C143	Same as C142	
C144	10mf, 85°C, 10V (Electrolytic)	1513-0100-001
C145	.001mf, +80 -20%, 500V Z5U (Disc.)	1503-0102-001
C146	Same as C145	
C147	Same as C145	

Item No.	Description	Part No.
	CAPACITORS	
C148	250mf, 85°C, 16V (Electrolytic)	1511-0251-002
C149	1000mf, 85°C, 16V (Electrolytic)	1511-0102-002
C150	250mf, 85°C, 10V (Electrolytic)	1511-0251-001
C151	*	
C152	*	
	* The value of these capacitors depends on frequency and are given below:	
	29-35MHz: Receiver Certification No. RL14A	
C101	33pf, 10%, 500V, NPO (Disc.)	1500-0330-605
C102	300pf, 5%, 50V (Mica)	1506-0301-550
C103	1.2pf, 10% (Composition)	1510-0129-900
C104	27pf, 10%, 500V, NPO (Disc.)	1500-0270-605
C105	1.2pf, 10% (Composition)	1510-0129-900
C106	22pf, 10%, 500V, NPO (Disc.)	1500-0220-605
C151	2.7pf, 10%, 500V, NPO (Disc.)	1500-0279-905
C152	15pf, 10%, 500V, NPO (Disc.)	150C-0150-605
	35-44 MHz¾ Receiver Certification No. RL14B	
C101	22pf, 10%, 500V, NPO (Disc.) .	1500-0220-605
C102	220pf, 5%, 50V (Mica)	1506-0221-550
C103	1pf, 10% (Composition)	1510-0010-900
C104	18pf, 10%, 500V, NPO (Disc.)	1500-0180-605
C105	0.82pf, 10% (Composition)	1510-0828-900
C106	12pf, 10%, 500V, NPO (Disc.)	1500-0120-605
C151	2.2pf, ±0.25pf, NPO (Disc.)	1500-0229-205
C152	10pf, 10%, 500V, NPO (Disc.)	1500-0100-905
	44-50 MHz: Receiver Certification No. RL14C	
C101	15pf, 10%, 500V, NPO (Disc.)	1500-0150-605
C102	150pf, 5%, 50V (Mica)	1506-0151-550
C103	0.82pf, 10% (Composition)	1510-0828-900
C104	10pf, 10%, 500V, NPO (Disc.)	1500-0100-905
C105	0.82pf, 10% (Composition)	1510-0828-900
C106	82.pf, 10%, 500V, NPO (Disc.)	1500-0829-905
C151	2.2pf, ±0.25pf, NPO (Disc.)	1500-0229-205
C152	8.2pf, 10%, 500V, NPO (Disc.)	1500-0829-905
	COILS	
L101	Coil RF (Yel)	1800-3191-402
L102	Same as L101	
L103	Same as L101	
L104	Coil RF (Wht)	1800-3191-401
L105	Coil TMR	1801-1236-900
L106	Coil. Shielded	1802-3182-700
L107	Same as L106	
L108	Coil	1800-3151-700
T101	Coil IF 10.7 Input	1800-3190-300
T102	Coil IF 10.7 Out	1800-3190-400
	TRANSISTORS	
Q 101	MOS FET	4811-0000-001
Q102	Silicon NPN	4801-0000-100
Q103	Junct FET	4811-0000-030
Q104	Silicon NPN	4801-0000-010

Item No.	Description	Part No.
	TRANSISTORS	
Q105	Same as Q104	
Q106	Silicon PNP	4801-0000-060
Q107	Silicon NPN	4801-0000-010
Q108	Same as Q107	
Q109	Same as Q107	
Q110	Silicon PNP	4801-0000-135
Q111	Same as Q110	
Q112	Silicon NPN Power	4802-0000-002
Q113	Same as Q112	
	DIODES	
CR101	Diode, Silicon	4805-1241-200
CR102	Diode, Zener (8.2V)	4808-0000-009
CR103	Diode, Silicon Rectifier	4806-0000-004
	INTEGRATED CIRCUITS	
IC101	IC, 10.7 IF	3130-3167-901
IC120	IC, 455 KHzDetector	3130-3157-603
	FILTER	
CF-1	455 KHz Ceramic Filter	2700-0000-008
	CRYSTAL	
Y113	10.245 MHz (301-516-1) or	2301-3151-601
	11.155 MHz (301-516-2)	2301-3151-602

5-2 TRANSMITTER BOARD 500-996

RESISTORS

All Resistors are ±10%, ¼W, unless otherwise noted.

Item No.	Description	Part No.
R201	10K	
R202	100K	
R203	10K	
R204	Trimmer, 10K	4751-0103-001
R205	3.9K	
R206	2.7K	
R207	6.8K	
R208	68K	
R209	18K	
R210	470 ohm	
R211	10K	
R212	39K	
R213	120K	
R214	27K	
R215	39K	
R216	Trimmer, 10K	4751-0103-001
R217	470 ohm	
R218	270 ohm	
R219	27 ohm	
R220	3.2 ohm	4701-0339-042
R221	18 ohm	
R222	10 ohm	
R223	10 ohm	
R224	22 ohm	
R225	100 ohm	
R226	47 ohm	
R227	270 ohm	
R228	470 ohm	
R229	3.9K	
R230	10 ohm	
R231	100 ohm	
R232	100 ohm	
R233	10 ohm	
R234	10K	
R235	82K	
R236	4.7K	
R237	100 ohm	
R238	150 ohm	
R239	27K	
R240	2.7K	
R241	100 ohm, 1W, 10%	4701-0101-042
R242	68K	
R243	100K	
R244	100K	
R245	120 ohm	
R246	180 ohm	
R247	47K	
R248	27K	
R250	150 ohm	

CAPACITORS

Item No.	Description	Part No.
C201	.01mf, 10%, 100V (Mylar Film)	1508-0103-610
C202	47pf, 5%, 50V (Mica)	1507-0470-001
C203	10mf, 85°C, 10V (Electrolytic)	1513-0100-001
C204	.1mf, 20%, 12V (Disc.)	1502-0104-005
C205	25mf, 85°C, 10V (Electrolytic)	1513-0250-001
C206	.47mf, +80 -20%, 3V (Disc.)	1502-0474-001
C207	.1mf, 20%, 12V (Disc.)	1502-0104-005
C208	.0033mf, 10%, 100V (Mylar Film)	1508-0332-610
C209	.022mf, 10%, 100V (Mylar Film)	1508-0223-610
C210	.1mf, 20%, 12V (Disc.)	1502-0104-005
C211	.47mf, +80 -20%, 3V (Disc.)	1502-0474-001
C212	.1mf, 20%, 12V (Disc.)	1502-0104-005
C213	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C214	.05mf, +80 -20%, 16V (Disc.)	1502-0503-003
C215	10mf, 20%, 25V (Tantalum)	1515-0100-005
C217	4-40pf, MICA Trimmer	1517-0000-009
C218	90-400pf, MICA Trimmer	1517-0000-008
C219	220pf, 5%, 500V MICA (29-41 MHz)	1504-0221-505
	82pf, 5%, 500V MICA (41-50 MHz)	1504-0820-505
C220	390pf, 5%, 500V MICA (29-32 MHz)	1504-0391-505
	360pf, 5%, 500V MICA (32-35 MHz)	1504-0361-505
	300pf, 5%, 500V MICA (35-38 MHz)	1504-0301-505
	250pf, 5%, 500V MICA (38-41 MHz)	1504-0251-505
	200pf, 5%, 500V MICA (41-44 MHz)	1504-0201-505
	180pf, 5%, 500V MICA (44-47 MHz)	1504-0181-505
	150pf, 5%, 500V MICA (47-50 MHz)	1504-0151-505
C221	360pf, 5%, 50V MICA (29-32 MHz)	1506-0361-550
	270pf, 5%, 50V MICA (32-35 MHz)	1506-0271-550
	250pf, 5%, 50V MICA (35-38 MHz)	1506-0251-550
	200pf, 5%, 50V MICA (38-41 MHz)	1506-0201-550
	180pf, 5%, 50V MICA (41-44 MHz)	1506-0181-550
	150pf, 5%, 50V MICA (44-47 MHz)	1506-0151-550
	120pf, 5%, 50V MICA (47-50 MHz)	1506-0121-550
C222	120pf, 5%, 50V MICA (29-32 MHz)	1506-0121-550
	100pf, 5%, 50V MICA (32-35 MHz)	1506-0101-550
	82pf, 5%, 50V MICA (35-38 MHz)	1506-0820-550
	75pf, 5%, 50V MICA (38-41 MHz)	1506-0750-550
	56pf, 5%, 50V MICA (41-47 MHz)	1506-0560-550
	47pf, 5%, 50V MICA (47-50 MHz)	1506-0470-550
C223	100pf, 5%, 50V MICA (29-32 MHz)	1506-0101-550
	82pf, 5%, 50V MICA (32-35 MHz)	1506-0820-550
	68pf, 5%, 50V MICA (35-38 MHz)	1506-0680-550
	56pf, 5%, 50V MICA (38-41 MHz)	1506-0560-550
	47pf, 5%, 50V MICA (41-47 MHz)	1506-0470-550
	36pf, 5%, 50V MICA (47-50 MHz)	1506-0360-550
C224	.01, +80 -20%, 16V (Disc.)	1502-0103-003
C225	220pf, 5%, 50V MICA (29-35 MHz)	1506-0221-550
	150pf, 5%, 50V MICA (35-41 MHz)	1506-0151-550
	100pf, 5%, 50V MICA (41-44 MHz)	1506-0101-550
	82pf, 5%, 50V MICA (44-50 MHz)	1506-0820-550

Item No.	Description	Part No.
	CAPACITORS	
C226	470pf, 5%, 50V MICA (29-35 MHz)	1506-0471-550
	360pf, 5%, 50V MICA (35-50 MHz)	1506-0361-550
C227	150pf, 5%, 50V MICA (29-35 MHz)	1506-0151-550
	100pf, 5%, 50V MICA (35-41 MHz)	1506-0101-550
	82pf, 5%, 50V MICA (41-44 MHz)	1506-0820-550
	75pf, 5%, 50V MICA (44-50 MHz)	1506-0750-550
C228	.01, +80 -20%, 16V (Disc.)	1502-0130-003
C229	360pf, 5%, 50V MICA (29-32 MHz)	1506-0361-550
	300pf, 5%, 50V MICA (32-35 MHz)	1506-0301-550
	270pf, 5%, 50V MICA (35-38 MHz)	1506-0271-550
	250pf, 5%, 50V MICA (38-41 MHz)	1506-0251-550
	220pf, 5%, 50V MICA (41-44 MHz)	1506-0221-550
	180pf, 5%, 50V MICA (44-50 MHz)	1506-0181-550
C230	1000pf, 5%, 50V MICA (29-41 MHz)	1507-0102-004
	470pf, 5%, 50V MICA (41-50 MHz)	1506-0471-550
C231	.005mf, +80 -20%, 500V Z5U (Disc.)	1503-0502-002
C232	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C233	300pf, 5%, 50V MICA (29-32 MHz)	1506-0301-550
	220pf, 5%, 50V MICA (32-38 MHz)	1506-0221-550
	200pf, 5%, 50V MICA (38-41 MHz)	1506-0201-550
	150pf, 5%, 50V MICA (41-44 MHz)	1506-0151-550
	120pf, 5%, 50V MICA (44-50 MHz)	1506-0121-550
C235	680pf, 5%, 50V MICA (29-32 MHz)	1506-0681-550
	560pf, 5%, 50V MICA (32-38 MHz)	1506-0561-550
	390pf, 5%, 50V MICA (38-44 MHz)	1506-0391-550
	220pf, 5%, 50V MICA (44-50 MHz)	1506-0221-550
C236	100pf, 5%, 50V (Mica)	1507-0102-004
C237	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C238	390pf, 5%, 50V MICA (29-32 MHz)	1506-0391-550
	360pf, 5%, 50V MICA (32-38 MHz)	1506-0361-550
	270pf, 5%, 50V MICA (38-44 MHz)	1506-0271-550
	180pf, 5%, 50V MICA (44-50 MHz)	1506-0181-550
C239	.1mf, 20%, 12V (Disc.)	1502-0104-005
C240	27pf, 10%, 500V, NPO (Disc.)	1500-0270-605
C241	5pf, 10%, 500V NPO (Disc.)	1500-0050-905
C242	.1mf, 20%, 12V (Disc.)	1502-0104-005
C243	150pf, 5%, 50V (Mica)	1506-0151-550
C244	Same as C243	
C246	2-18pf, Trimmer	1517-0000-001
C247	36pf, 5%, 50V, NPO (Disc)	1500-0360-550
*C248	Same as C246	
*C249	Same as C247	
*C250	Same as C246	
*C251	Same as C247	
*C252	Same as C246	
*C253	Same as C247	
C254	4-40pf, MICA Trimmer	1517-0000-009
C255	47pf, 5%, 500V (Mica)	1504-0470-505
C269	820pf, 5%, 500V MICA (29-38 MHz)	1504-0821-505
	470pf, 5%, 500V MICA (38-50 MHz)	1504-0471-505
C270	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C271	390pf, 5%, 50V (Mica)	1506-0391-550
C272	.0047mf, 10%, 100V (Mylar Film)	1508-0472-610

*Used on BTL-304 ONLY

Item No.	Description	Part No.
	COILS	
L201	Coil, Final Output	1801-3208-700
L202	Coil, Antenna Output (29-41 MYz)	1801-3208-600
	Coil, Antenna Output (41-50 MHz)	1801-1274-200
L203	Coil, RF Choke	1803-3189-800
L204	Choke Bead Coil	1803-1245-900
L206	Coil, Modulator (29-41 MHz)	1800-3189-200
	Coil, Modulator (41-50 MHz)	1800-3208-300
L208	Ferrite Bead	2502-0000-001
L209	Same as L208	
L210	Same as L208	
L211	Same as L208	
L212	Same as L208	
T301	Transformer, SWR Bridge	1800-3190-100
T302	Transformer, Driver (Violet)	1800-3189-701
T303	Transformer (Blue)	1800-3189-601
T304	Transformer (Green)	1800-3189-501
T305	Transformer (Yellow)	1800-3189-401
T306	Transformer (Orange)	1800-3189-301
	TRANSISTORS	
Q201	Junct. FET	4811-0000-030
Q202	Silicon NPN	4801-0000-010
Q203	Same as Q202	
Q204	Silicon, RF Power NPN	4804-3169-503
Q205	Silicon, RF Power NPN	4804-3169-604
Q206	Silicon NPN	4804-0000-015
Q207	Silicon NPN (BT)	4801-0000-003
Q208	Silicon NPN	4801-0000-010
Q209	Silicon NPN (BT)	4801-0000-003
Q210	Silicon NPN	4801-0000-005
Q211	Silicon NPN (BT)	4801-0000-003
Q212	Same as Q211	
NOTE:	BT=Blue Top	
	INTEGRATED CIRCUITS	
IC201	IC, Divider	3130-3157-607
	Shield, I.C.	2508-1265-900
	DIODES	
CR201	Diode Silicon	4805-1241-200
CR202	Diode Silicon	4805-1241-200
CR203	Diode Silicon	4805-1241-200
CR204	Diode Varicap MY2209	4809-0000-001
CR205	Diode Varicap MY2209	4809-0000-001
CR206	Diode Zener 8.2V 1W 47384	4808-0000-009

5-3 LED DISPLAY BOARD (BTL-301) 302-057

Item No.	Description	Part No.
	RESISTORS	
	All Resistors are ¼W, 10%, unless otherwise noted.	
R301	680 ohm	
R302	470 ohm	
	DIODES	
LD301	LED (Red)	4810-0000-001
LD302	Same as LD301	

5-4 LED DISPLAY BOARD (BTL-304) 302-057

Item No.	Description	Part No.
	RESISTORS	
	All Resistors are ¼W, 10%, unless otherwise noted.	
R301	680 ohm	
R302	470 ohm	
	DIODES	
LD301	LED (Red)	4810-0000-001
LD302	Same as LD301	
LD 303	Same as LD301	
LD304	Same as LD301	
LD305	Same as LD301	

5-5 CHASSIS ASSEMBLY

Item No.	Description	Part No.
	ELECTRICAL COMPONENTS	
R1	Res Var. 5K/SW	4750-1230-305
R2	Res Var. 7.5K	4750-1230-306
C1	15pf, 10% NPO (Disc.)	1501-0150-001
C2	.05mf, +80 -20%, 25V (Disc.)	1501-0503-003
RY-1	Relay, Transmit-Receive, 12VDC	4500-0000-002
SPK-1	Speaker, 3.2 ohm, 4 inch square	
	(Assembly with Mounting Bracket)	301-934
Y100	Crystals, Receive (Specify Frequency)	302-032
		2316-0000-000
Y200	Crystals, Transmit (Specify Frequency)	302-075
		2317-0000-000
SW1,SW2	Switch, Push, Interlocking	5112-6037-302
J1	Connector, Antenna	2105-0000-020
J2	Connector, Chassis - 4 cond. Microphone	2105-0000-021
	Assy. Chassis Mic. Connector & Bracket	102-628
P2	Connector, Cable - 4 cond. Microphone	2104-0000-001
P1	Connector, Chassis, Power	2104-0000-004
S1	Connector, Cable, Power	2108-1272-901
F1	Fuse, 10 Amp., 3 AG	5106-0000-007
	Microphone, Ceramic (No Connector)	1300-5080-902
	Microphone Assy. (Complete)	600-337-6
	DC Power Cord Assy.	102-521-3
	Cable, Shielded, Audio	Jefflex
	Cable, Coaxial 50 ohm Teflon	RG-188/U
	MECHANICAL COMPONENTS	
	Faceplate (BTL-301)	2403-3206-300
	Faceplate (BTL-304)	2403-3206-500
	Front Panel (Bezel)	1405-6034-301
	Knob, Volume & Squelch	2402-3178-301
	Socket Pins, Crystal	2830-0000-004
	Heat Sink, Driver Transistor	5400-0000-002
	Heat Sink, Final Transistor	5400-3192-100
	Bracket, Relay Mounting	1400-1246-600
	Terminal Board, 3 Lug (Rear Panel)	2103-3007-907
	Foot, Rubber	1402-0000-001
	Cabinet/Wrap Assembly	1408-6035-202
	Bracket, Mobile Mounting	1400-3192-400
	Bracket, Security	1400-1241-500
	Bracket, Mic. Conn.	1400-1258-200

SECTION 6 SERVICE MANUAL ADDENDUM

The following modifications now exist in the BTL-301 and BTL-304 VHF FM transceivers. The revisions include the addition of a Power Regulator Board, 302-342 and the modification of the existing Transmitter Board 500-996. Effective June, 1974.

ADDENDUM CONTENTS

6-1 TEXT REVISIONS

Section 1; Page 3

Specifications are the same as described in Section 1 except for the following change:

Silicon Transistors (Total)..... 26

Section 2; Page 4

Power output section description is the same as described in Section 2 except for the following changes:

c. SWR Bridge

In the event of a load mismatch at the antenna terminals, the SWR Bridge consisting of T201, R218 and CR203 will detect the mismatch and send a signal to the Driver Limiter. The Driver Limiter (Q208, Q401 and Q402) will then bias Q205 in an off condition, preventing possible damage to the power amplifier (Q204). Load mismatch is detected by comparing the phases of output voltage and current to determine if standing waves exist on the line.

Transmitter tuning procedure is the same as described in Section 3 except for the following changes:

3-7-10 T203: Connect the VTVM probe to the junction of T202 and C270 and the common lead to ground. Adjust the secondary core and then the primary core for a dip in the meter reading. Normal voltage should be 13.0 V.

3-7-11 T202: Adjust both primary and secondary for maximum RF power output as indicated on wattmeter.

6-2 COMPONENT REVISIONS TO TRANSMITTER BOARD 500-996

See 6-4 and 6-5 for exact locations of component added.

Components Added:

C273, .01 μf, +80-20%, 50V, YM (Disc.) 1503-0103-007 - Copper Side

C274, .01 μf, +80-20%, 50V, YM (Disc.) 1503-0103-007 - Copper Side

C275, .01 μf, +80-20%, 50V, YM (Disc.) 1503-0103-007 - Copper Side

C276, .01 μf, +80-20%, 50V, YM (Disc.) 1503-0103-007 - Component Side

J1..... Copper Side
J2..... Component Side
J3..... Component Side

Components Removed:

R220 3.2 Ohms ±10% 1/4W

R226 47 Ohms ±10% 1/4W

R232 100 Ohms ±10% 1/4W

R333 10 Ohms ±10% 1/4W

R234 10K ±10% 1/4W

C234 NOT USED

Q210 Silicon NPN 4801-0000-005

Board Jumpers (TX Bd. To Pwr. Reg. Bd.)

Point A Yellow Wire

Point B Orange Wire

Point C Black Wire

Point D Green Wire

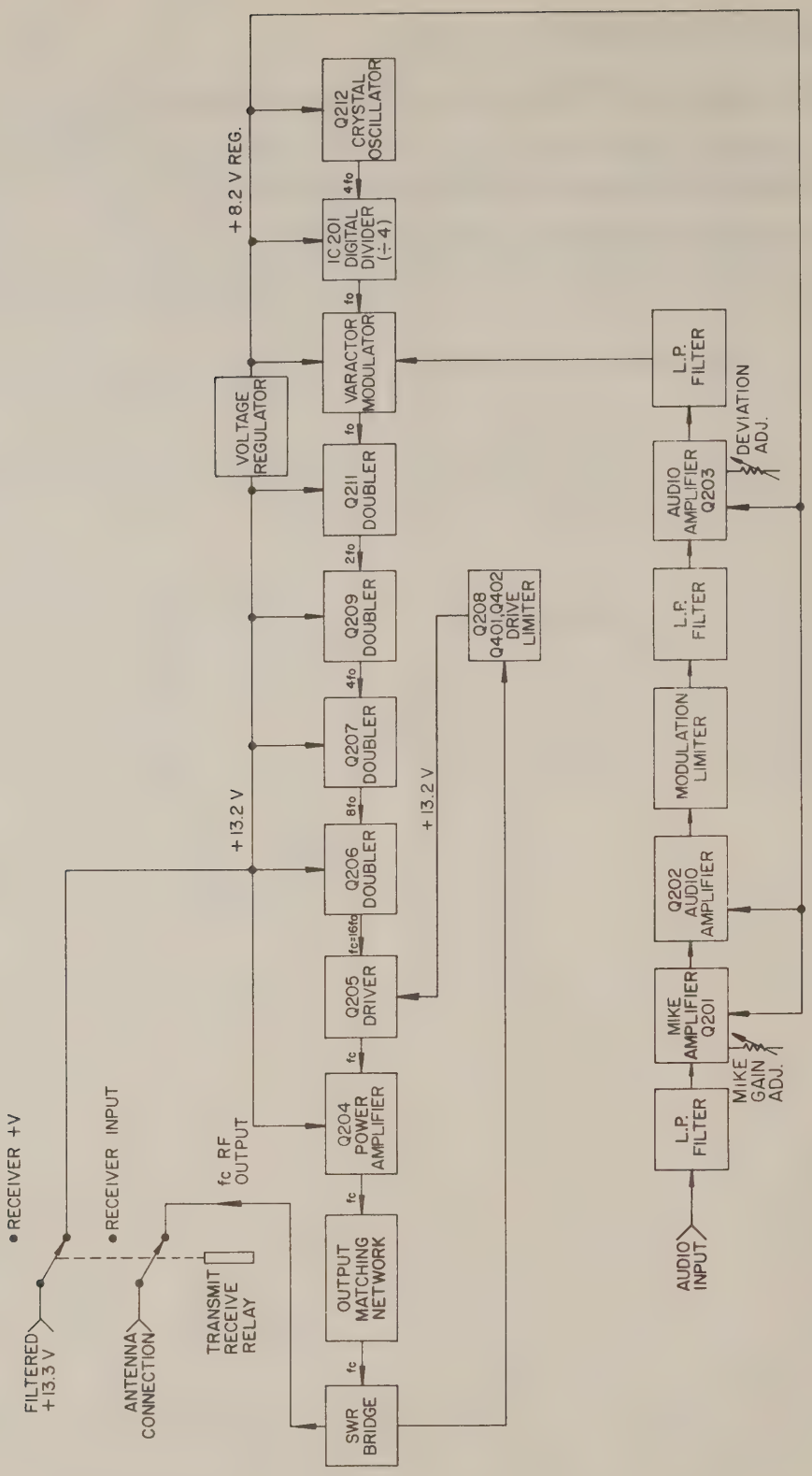
CAPACITANCE VALUE MODIFICATIONS

At 35 to 41 MHz, C219 should have an 82 PF value instead of a 220 PF value.

At 35 to 41 MHz, C269 should have a 1000 PF value instead of an 820 PF value at 35 to 38 MHz and a 470 PF value at 38-41 MHz.

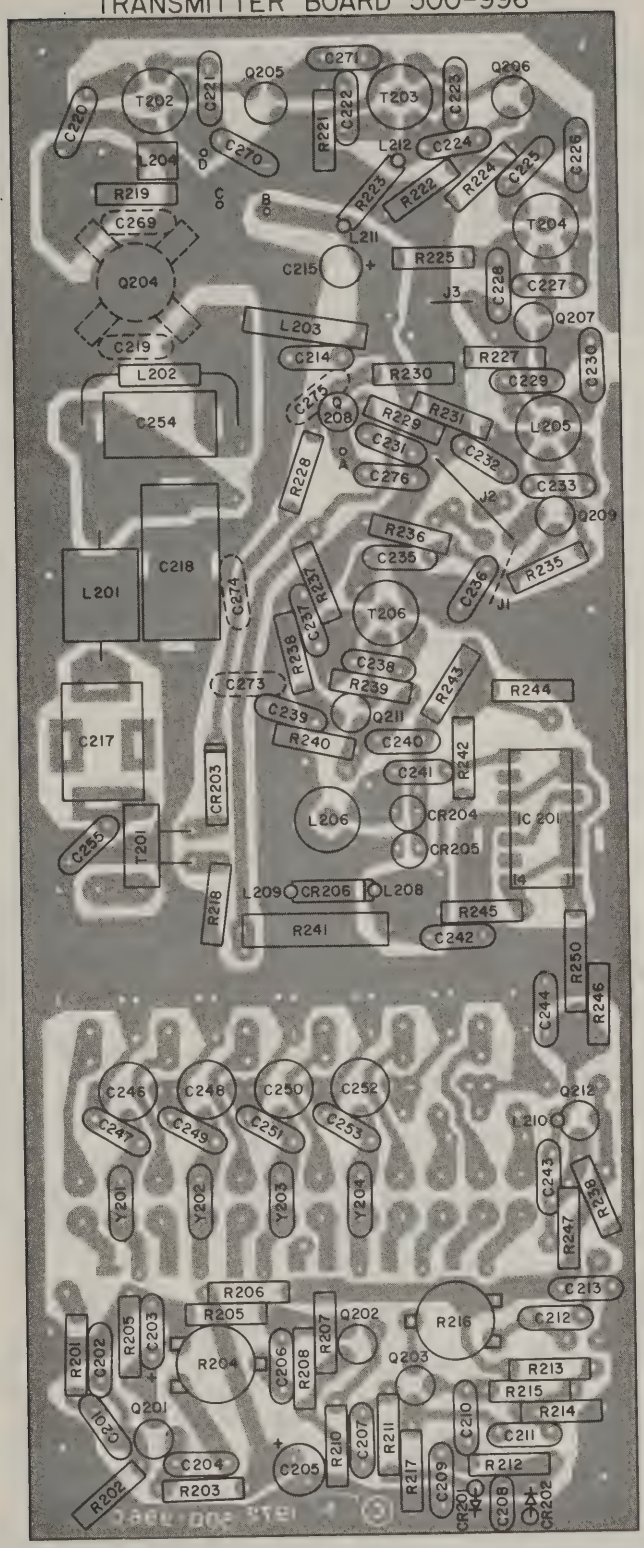
At 41 to 50 MHz, C269 is no longer used.

See Transmitter Component Value Table on 6-9 and 6-10.



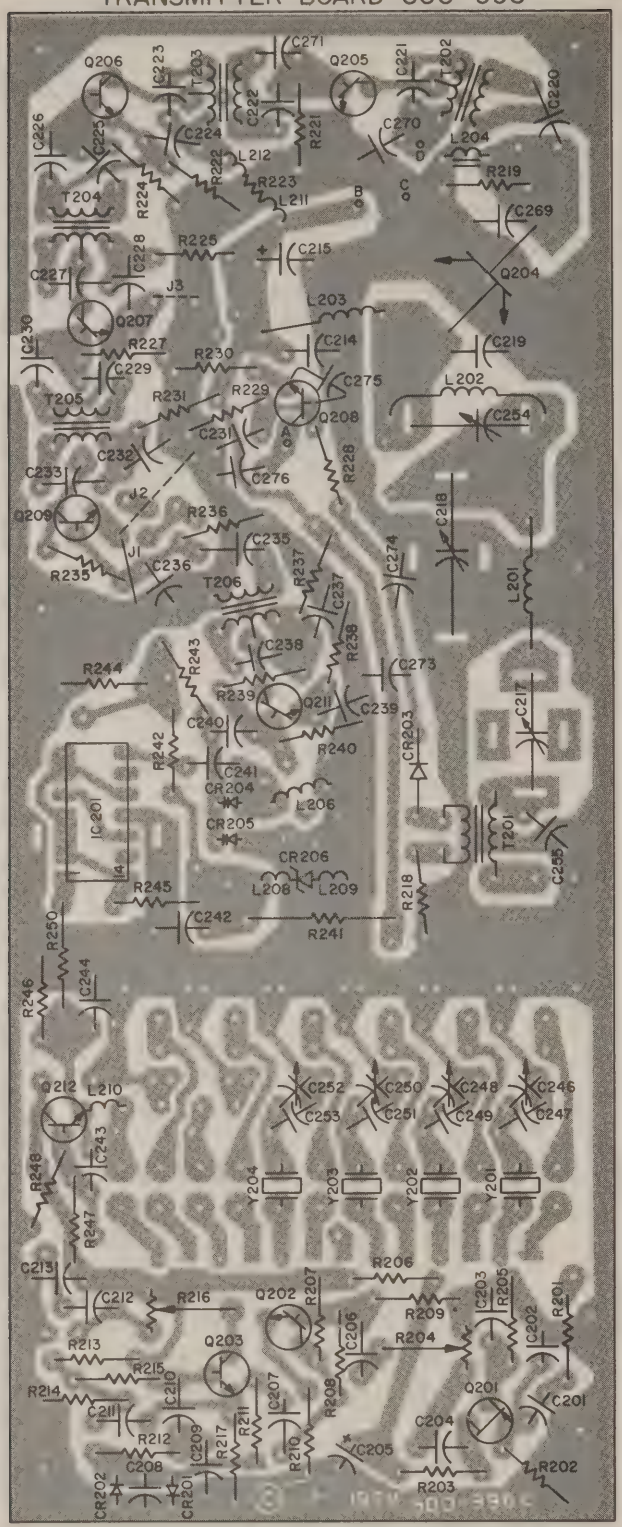
6-3 TRANSMITTER BLOCK DIAGRAM

TRANSMITTER BOARD 500-996

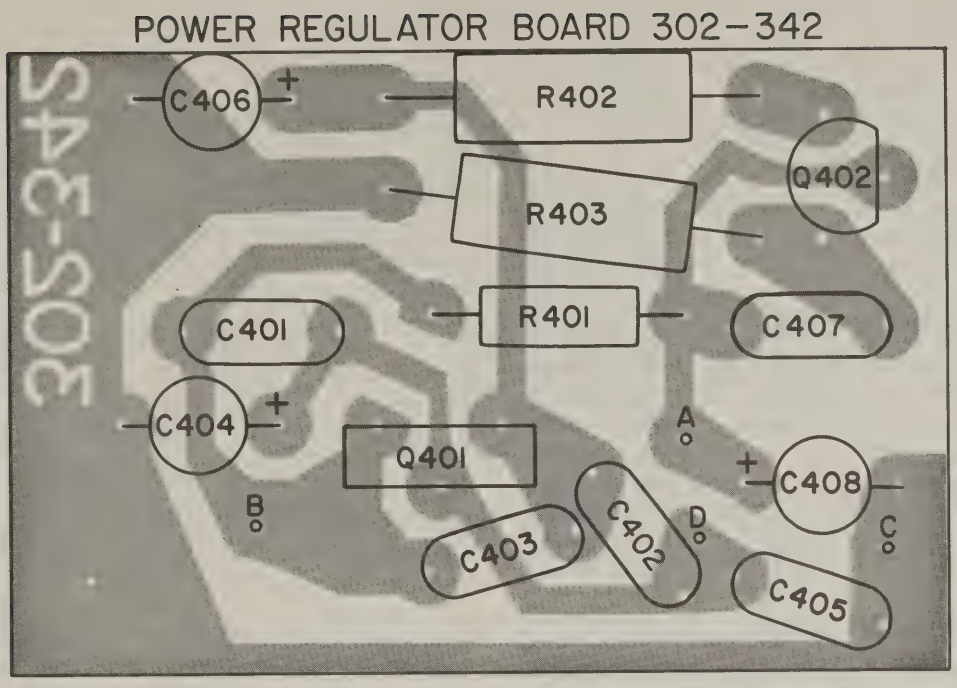


6-4 TRANSMITTER BOARD PARTS PLACEMENT DIAGRAM

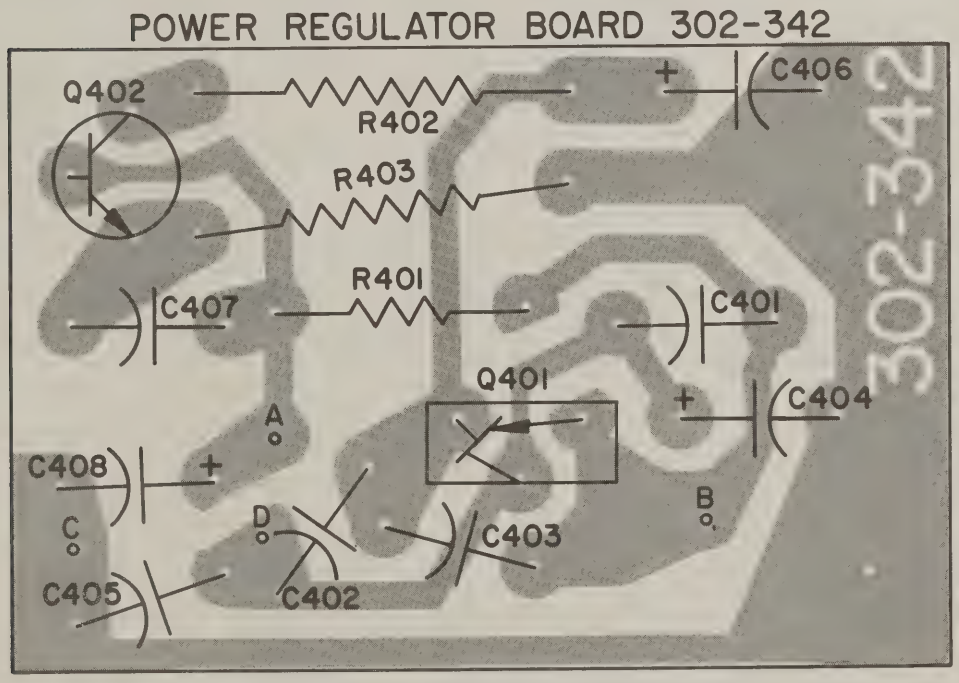
TRANSMITTER BOARD 500-996



6-5 TRANSMITTER BOARD PARTS OVERLAY DIAGRAM



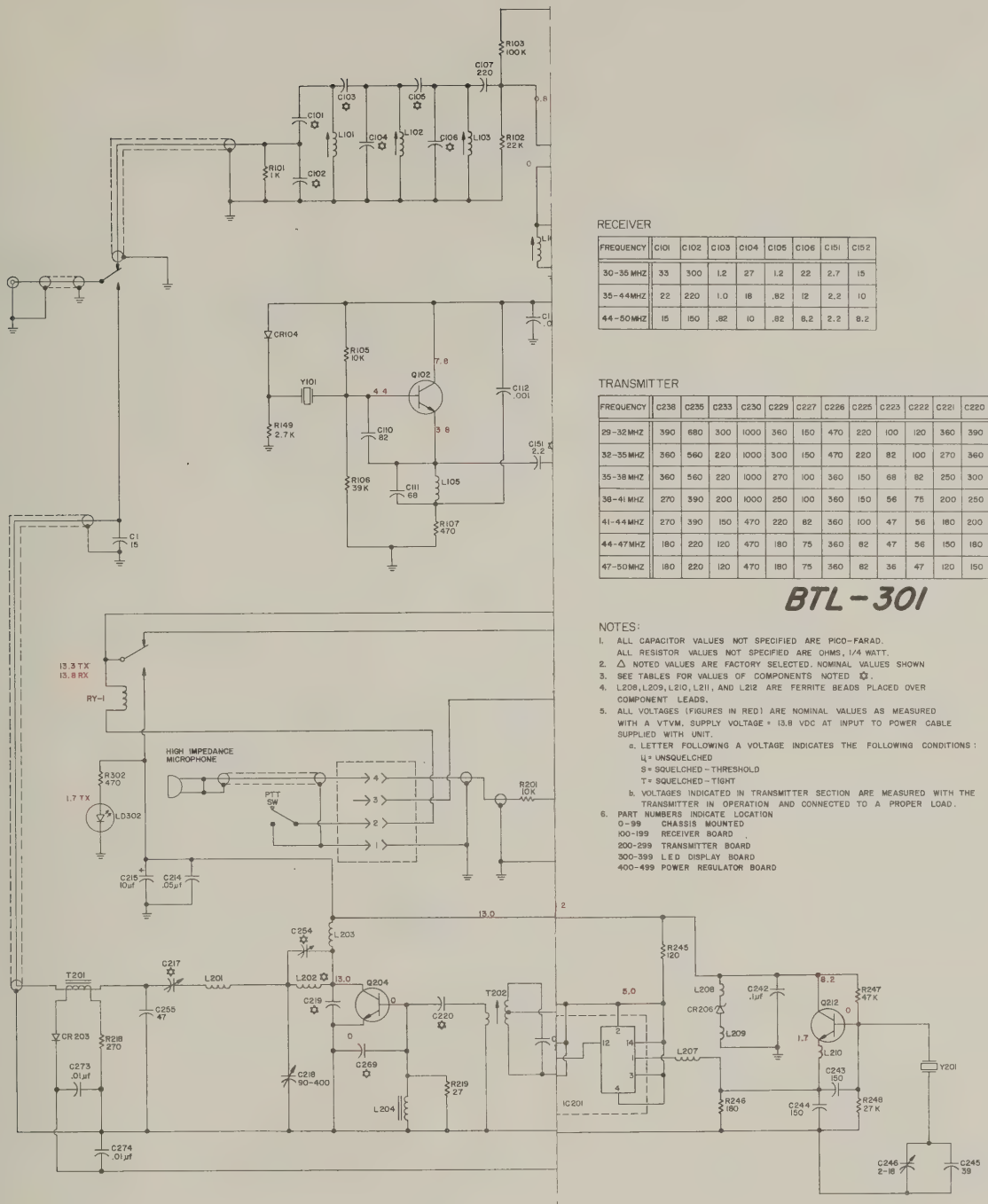
6-6 POWER REGULATOR BOARD PARTS PLACEMENT DIAGRAM



6-7 POWER REGULATOR BOARD PARTS OVERLAY DIAGRAM

6-8 POWER REGULATOR BOARD 302-342 PARTS LIST

Item No.	Description	Part No.
	RESISTORS	
R401	3.3K 10% ¼W	4701-0332-042
R402	150 ohms 10% ½W	4701-0151-044
R403	150 ohms 10% ½W	4701-0151-044
	CAPACITORS	
C401	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C402	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C403	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C404	10 uf 20% 25V TANT	1515-0100-005
C405	150 pf 20% 50V Z5F	1523-0151-002
C406	10 uf 20% 25V TANT	1515-0100-005
C407	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C408	10 uf 20% 25V TANT	1515-0100-005
	TRANSISTORS	
Q401	Silicon SPS 952	4801-0000-010
Q402	Silicon Power PNP SJE 1608	4802-0000-003



RECEIVER

FREQUENCY	C101	C102	C103	C104	C105	C106	C151	C152
30-35 MHZ	33	300	1.2	27	1.2	22	2.7	15
35-44MHZ	22	220	1.0	18	.82	12	2.2	10
44-50MHZ	15	150	.82	10	.82	8.2	2.2	8.2

TRANSMITTER

FREQUENCY	C238	C235	C233	C230	C229	C227	C226	C225	C223	C222	C221	C220	C219	C269	L206	L202	C217	C254
29-32MHZ	390	680	300	1000	360	150	470	220	100	120	360	390	220	820	301-892	302-086	4-60	4-60
32-35MHZ	360	560	220	1000	300	150	470	220	82	100	270	360	220	820	301-892	302-086	4-40	4-40
35-38MHZ	360	560	220	1000	270	100	360	150	68	82	250	300	82	1000	301-892	302-086	4-40	4-40
38-41MHZ	270	390	200	1000	250	100	360	150	56	75	200	250	82	1000	301-892	302-086	4-40	4-40
41-44MHZ	270	390	150	470	220	82	360	100	47	56	180	200	82		302-083	102-742	4-40	4-40
44-47MHZ	180	220	120	470	180	75	360	82	47	56	150	180	82		302-083	102-742	4-40	4-40
47-50MHZ	180	220	120	470	180	75	360	82	36	47	120	150	82		302-083	102-742	4-40	4-40

BTL-301

NOTES:

1. ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD.
   ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT.
2. △ NOTED VALUES ARE FACTORY SELECTED. NOMINAL VALUES SHOWN
3. SEE TABLES FOR VALUES OF COMPONENTS NOTED ✡.
4. L208, L209, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER COMPONENT LEADS.
5. ALL VOLTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED WITH A VTVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE SUPPLIED WITH UNIT.
   a. LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
      U = UNSQUELCHED
      S = SQUELCHED - THRESHOLD
      T = SQUELCHED - TIGHT
   b. VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.
6. PART NUMBERS INDICATE LOCATION
   0-99 CHASSIS MOUNTED
   100-199 RECEIVER BOARD
   200-299 TRANSMITTER BOARD
   300-399 LED DISPLAY BOARD
   400-499 POWER REGULATOR BOARD

6-9 SCHEMATIC WITH VOLTAGES (BTL-301)

6-8 POWER REGULATOR BOARD 302-342 PARTS LIST

Item No.	Description	Part No.
	RESISTORS	
R401	3.3K 10% ¼W	4701-0332-042
R402	150 ohms 10% ½W	4701-0151-044
R403	150 ohms 10% ½W	4701-0151-044
	CAPACITORS	
C401	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C402	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C403	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C404	10 uf 20% 25V TANT	1515-0100-005
C405	150 pf 20% 50V Z5F	1523-0151-002
C406	10 uf 20% 25V TANT	1515-0100-005
C407	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C408	10 uf 20% 25V TANT	1515-0100-005
	TRANSISTORS	
Q401	Silicon SPS 952	4801-0000-010
Q402	Silicon Power PNP SJE 1608	4802-0000-003

RECEIVER

FREQUENCY	C101	C102	C103	C104	C105	C106	C151	C152
30-35 MHZ	33	300	1.2	27	1.2	22	2.7	15
35-44MHZ	22	220	1.0	18	.82	12	2.2	10
44-50MHZ	15	150	.82	10	.82	8.2	2.2	8.2

TRANSMITTER

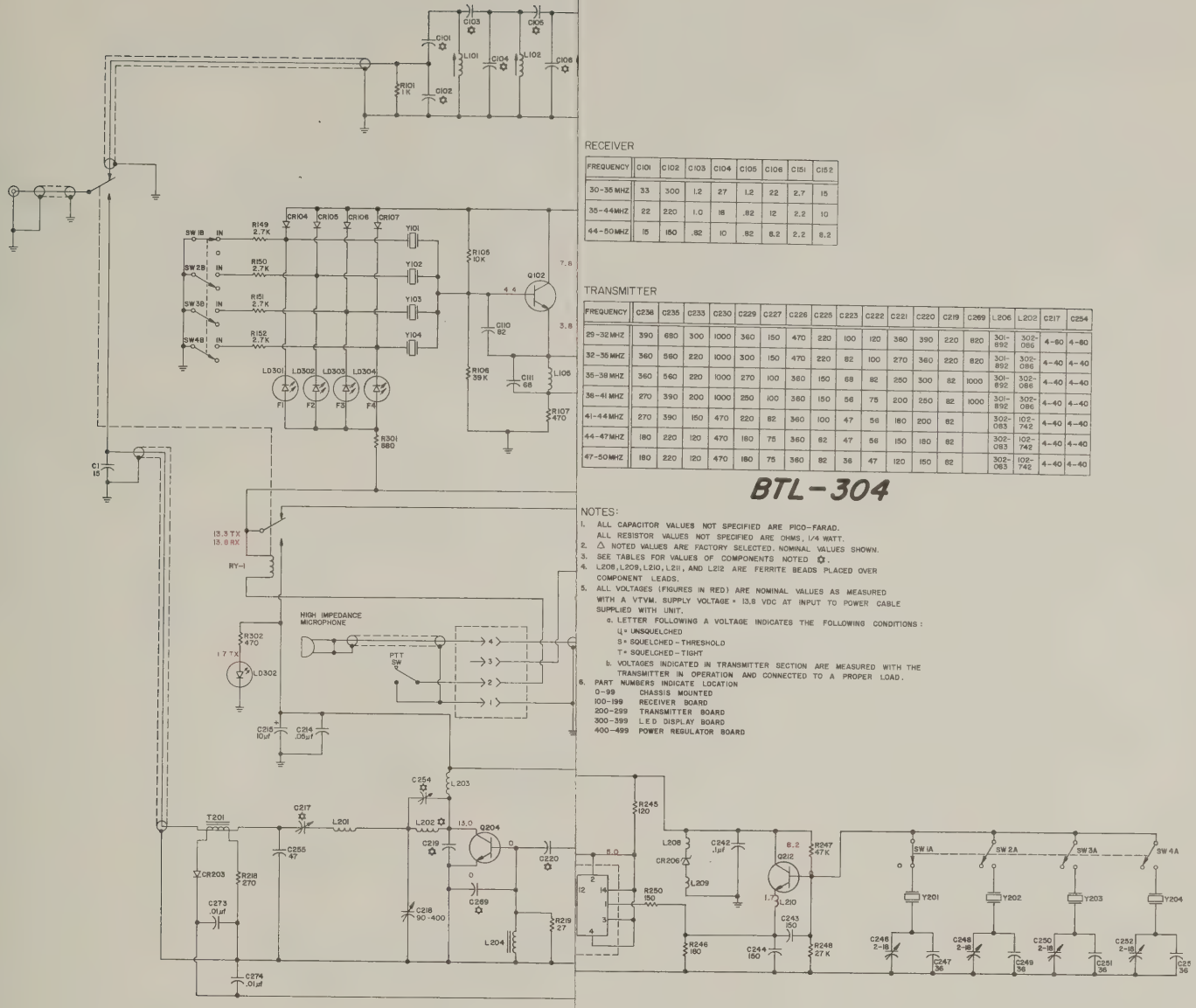
FREQUENCY	C238	C235	C233	C230	C229	C227	C226	C225	C223	C222	C221	C220	C219	C269	L206	L202	C217	C254
29-32 MHZ	390	680	300	1000	360	150	470	220	100	120	360	390	220	820	301-892	302-086	4-60	4-60
32-35 MHZ	360	560	220	1000	300	150	470	220	82	100	270	360	220	820	301-892	302-086	4-60	4-60
35-38 MHZ	360	560	220	1000	270	100	360	150	68	82	250	300	82	1000	301-892	302-086	4-60	4-60
38-41 MHZ	270	390	200	1000	250	100	360	150	56	75	200	250	82	1000	301-892	302-086	4-60	4-60
41-44 MHZ	270	390	150	470	220	82	360	100	47	56	180	200	82		302-083	102-742	4-60	4-60
44-47 MHZ	180	220	120	470	180	75	360	82	47	56	150	180	82		302-083	102-742	4-60	4-60
47-50 MHZ	180	220	120	470	180	75	360	82	36	47	120	150	82		302-083	102-742	4-60	4-60

BTL-301

NOTES:

1. ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD
   ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT
2. △ NOTED VALUES ARE FACTORY SELECTED NOMINAL VALUES SHOWN
3. SEE TABLES FOR VALUES OF COMPONENTS NOTED ☆
4. L208, L209, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER COMPONENT LEADS.
5. ALL VOLTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED WITH A VTVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE SUPPLIED WITH UNIT
   a LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS
   U = UNSQUELCHED
   S = SQUELCHED - THRESHOLD
   T = SQUELCHED - TIGHT
   b VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD
6. PART NUMBERS INDICATE LOCATION
   0-99 CHASSIS MOUNTED
   100-199 RECEIVER BOARD
   200-299 TRANSMITTER BOARD
   300-399 LED DISPLAY BOARD
   400-499 POWER REGULATOR BOARD

6-9 SCHEMATIC WITH VOLTAGES (BTL-301)



RECEIVER

FREQUENCY	C101	C102	C103	C104	C105	C106	C151	C152
30-35 MHZ	33	300	1.2	27	1.2	22	2.7	15
35-44MHZ	22	220	1.0	18	.82	12	2.2	10
44-50MHZ	15	150	.82	10	.82	8.2	2.2	8.2

TRANSMITTER

FREQUENCY	C238	C235	C233	C230	C229	C227	C226	C225	C223	C222	C221	C220	C219	C269	L206	L202	C217	C254
29-32 MHZ	390	680	300	1000	360	150	470	220	100	120	360	390	220	820	301-892	302-086	4-80	4-80
32-35 MHZ	360	560	220	1000	300	150	470	220	82	100	270	360	220	820	301-892	302-086	4-40	4-40
35-38 MHZ	360	560	220	1000	270	100	360	150	68	82	250	300	82	1000	301-892	302-086	4-40	4-40
38-41 MHZ	270	390	200	1000	250	100	360	150	56	75	200	250	82	1000	301-892	302-086	4-40	4-40
41-44 MHZ	270	390	150	470	220	82	360	100	47	56	180	200	82		302-083	102-742	4-40	4-40
44-47 MHZ	180	220	120	470	180	75	360	82	47	56	150	180	82		302-083	102-742	4-40	4-40
47-50 MHZ	180	220	120	470	180	75	360	82	36	47	120	150	82		302-083	102-742	4-40	4-40

BTL-304

NOTES:

1. ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD.
   ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT.
2. △ NOTED VALUES ARE FACTORY SELECTED. NOMINAL VALUES SHOWN.
3. SEE TABLES FOR VALUES OF COMPONENTS NOTED ✪.
4. L208, L209, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER COMPONENT LEADS.
5. ALL VOLTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED WITH A VTVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE SUPPLIED WITH UNIT.
   a. LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
      U = UNSQUELCHED
      S = SQUELCHED - THRESHOLD
      T = SQUELCHED - TIGHT
   b. VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.
6. PART NUMBERS INDICATE LOCATION
   0-99 CHASSIS MOUNTED
   100-199 RECEIVER BOARD
   200-299 TRANSMITTER BOARD
   300-399 L.E.D. DISPLAY BOARD
   400-499 POWER REGULATOR BOARD

6-10 SCHEMATIC WITH VOLTAGES (BTL-304)

RECEIVER

FREQUENCY	C101	C102	C103	C104	C105	C106	C151	C152
30-35 MHZ	33	300	1.2	27	1.5	185	2.7	15
35-44 MHZ	22	220	1.0	18	82	12	2.2	10
44-50 MHZ	15	150	.82	10	82	8.2	2.2	8.2

TRANSMITTER

FREQUENCY	C238	C235	C233	C230	C229	C227	C226	C225	C223	C222	C221	C220	C219	C269	C58	C54	C2,7	C254
29-32 MHZ	390	660	300	1000	360	50	470	220	100	20	360	390	220	680	NI 8192	1000 180	4-180	4-60
32-36 MHZ	360	560	220	1000	300	150	470	220	82	100	270	360	220	820	NI 8192	1000 180	4-40	4-60
35-38 MHZ	360	560	220	1000	270	130	360	150	68	82	250	300	82	1000	NI 8192	1000 180	4-40	4-60
38-41 MHZ	270	390	200	1000	250	100	360	150	56	75	200	250	82	1000	NI 8192	1000 180	4-40	4-60
41-44 MHZ	270	390	150	470	220	82	360	100	47	56	180	200	82		1000 365	680 180	4-40	4-60
44-47 MHZ	180	220	120	470	180	75	360	82	47	56	150	180	82		1000 365	680 142	4-40	4-60
47-50 MHZ	180	220	120	470	180	75	360	82	36	47	120	150	82		1000 365	680 142	4-40	4-60

BTL-304

NOTES

1. ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD
   ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT
2. Δ NOTED VALUES ARE FACTORY SELECTED. NOMINAL VALUES SHOWN
3. SEE TABLES FOR VALUES OF COMPONENTS NOTED Ω
4. L209, L209, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER COMPONENT LEADS
5. ALL VOLTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED WITH A VTVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE SUPPLIED WITH UNIT.
   a. LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS
      U = UNSQUELCHED
      S = SQUELCHED - THRESHOLD
      T = SQUELCHED - TIGHT
   b. VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD
6. PART NUMBERS INDICATE LOCATION
   0-99 CHASSIS MOUNTED
   100-199 RECEIVER BOARD
   200-299 TRANSMITTER BOARD
   300-399 LED DISPLAY BOARD
   400-499 POWER REGULATOR BOARD

6-10 SCHEMATIC WITH VOLTAGES (BTL-304)

SECTION 7 SERVICE MANUAL ADDENDUM

The following modifications now exist in the (BTL-301 and BTL-304) VHF FM Transceivers. The revisions pertain to the Transmitter Board 500-996. Effective October, 1974.

ADDENDUM CONTENTS

7-1 TEXT REVISIONS

SECTION 3

Transmitter tuning procedure is the same as described in Section 3 except for the following changes:

Page 5

3-7-6 Modulator Alignment

a. Connect the common lead of the VTVM to the A+ buss in the transmitter (Junction of R237, R231, etc.).

b. Connect the probe of the VTVM to the Junction of R237 and T206, (TP 6).

c. Tune the core of L206 for peak on the VTVM (maximum voltage drop across R237). Normal voltage is -0.8 volts.

3-7-7 T206: The common lead of the VTVM is left connected to the A+ buss during the remainder of the alignment. Before proceeding, back all of the bottom cores of transformers T202 through T206 until the cores are flush with the bottom of the P.C. Board. Connect the VTVM probe to the Junction of R231 and T205 (TP 7). Tune the primary (top core) of T206 for a peak reading on the VTVM (max. voltage drop across R231), and then adjust the bottom core of T206 for a peak reading. Normal voltage is -1.8 volts. In adjusting T203 through T206, the secondary (top core) is first peaked with the primary (bottom core) backed out of its winding, and then the primary is tuned. It is then permissable to peak both slugs.

3-7-8 T205: Connect the VTVM probe to the Junction of R225 and T204 (TP 8). Adjust the secondary core and then the primary core for a peak reading on the VTVM as in 5a. above. Normal voltage is -3.5 volts.

3-7-9 T204: Connect the VTVM probe to the Junction of R223 and T203 (TP 9). Adjust the secondary core and then the primary core for a peak reading as in 5a. above. Return to T205 and repeak the secondary and primary for peak reading at (TP 9). Repeak T204 for maximum reading at (TP 9). Repeat the tuning of T205 and T204 until a maximum peak is obtained at (TP 9). Normal voltage is -1.2 volts.

Steps 3-7-10 and 3-7-11 appear in this Section and Section 6-1. Replace them both with the following steps:

3-7-10 T203: Connect the VTVM probe to the Junction of R220 and T302 (TP 10). Adjust the secondary and primary cores of T203 as in 5a. above. Normal voltage is -0.1 volts at (TP 10).

7-2 TRANSMITTER BOARD 500-996

RESISTORS

All Resistors are ±10%, ¼W, unless otherwise noted.

Item No.	Description	Part No.
R201	10K	
R202	100K	
R203	10K	
R204	Trimmer, 10K	4751-0103-001
R205	3.9K	
R206	2.7K	
R207	6.8K	
R208	68K	
R209	18K	
R210	470 ohm	
R211	10K	
R212	39K	
R213	120K	
R214	27K	
R215	39K	
R216	Trimmer, 10K	4751-0103-001
R217	470 ohm	
R218	330 ohm, 5%	
R219	10 ohm (29-47 MHz) 15 ohm (47-50 MHz)	
R220	3.2 ohm	4701-0339-042
R221	18 ohm	
R222	10 ohm	
R223	10 ohm	
R224	22 ohm	
R225	100 ohm	
R226	47 ohm	
R227	270 ohm	
R228	470 ohm (29-32 MHz) 680 ohm (32-35 MHz) 820 ohm (35-38 MHz) 1.5K ohm (38-41 MHz) 1.8K ohm (41-44 MHz) 2.2K ohm (44-47 MHz) 2.7K ohm (47-50 MHz)	
R229	1.5K	
R230	10 ohm	
R231	100 ohm	
R235	82K	
R236	4.7K	
R237	100 ohm	
R238	150 ohm	
R239	27K	
R240	2.7K	
R241	100 ohm, 1W, 10%	4701-0101-042
R242	68K	
R243	100K	
R244	100K	
R245	120 ohm	
R246	180 ohm	
R247	47K	
R248	27K	
R250	150 ohm	

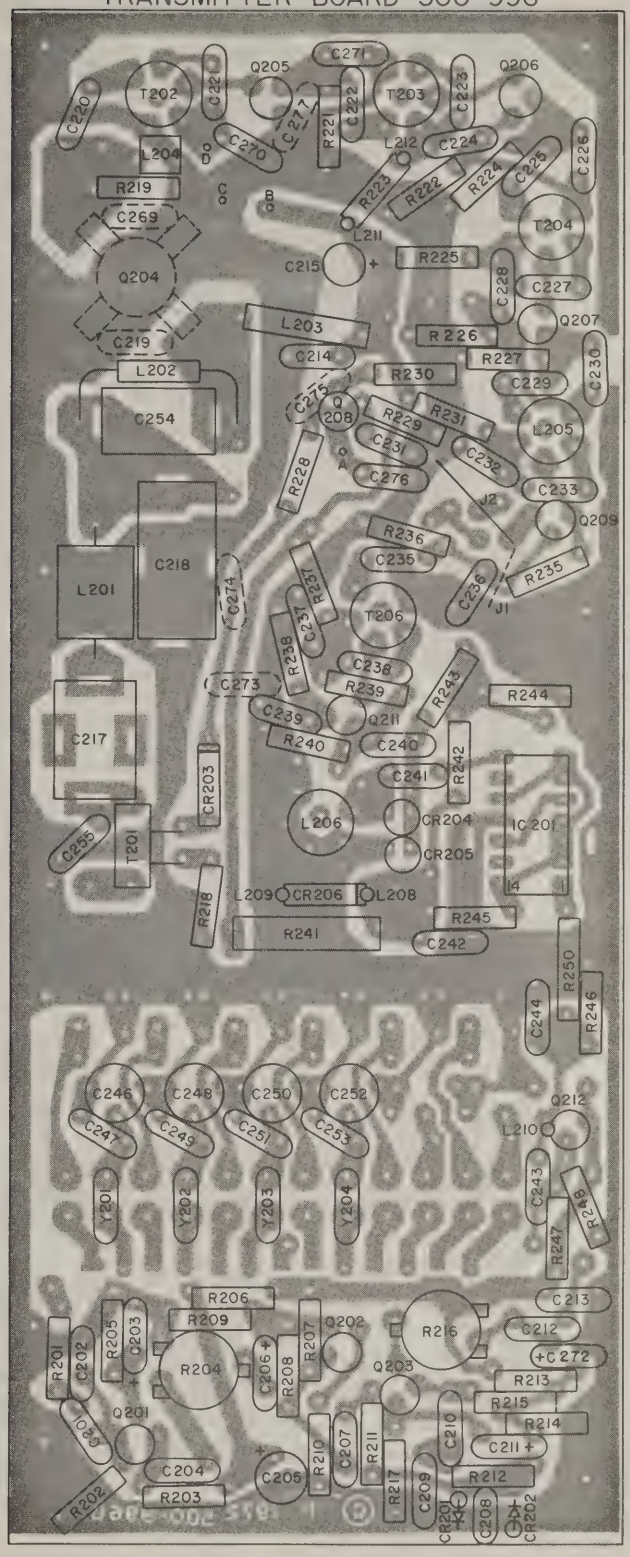
CAPACITORS

Item No.	Description	Part No.
C201	.01mf, 10%, 100V (Mylar Film)	1508-0103-610
C202	47pf, 5%, 50V (Mica)	1507-0470-001
C203	10mf, 85°C, 10V (Electrolytic)	1513-0100-001
C204	.1mf, 20%, 12V (Disc.)	1502-0104-005
C205	25mf, 85°C, 10V (Electrolytic)	1513-0250-001
C206	.47mf, +80 -20%, 3V (Disc.)	1502-0474-001
C207	.1mf, 20%, 12V (Disc.)	1502-0104-005
C208	.0033mf, 10%, 100V (Mylar Film)	1508-0332-610
C209	.022mf, 10%, 100V (Mylar Film)	1508-0223-610
C210	.1mf, 20%, 12V (Disc.)	1502-0104-005
C211	.47mf, +80 -20%, 3V (Disc.)	1502-0474-001
C212	.1mf, 20%, 12V (Disc.)	1502-0104-005
C213	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C214	.05mf, +80 -20%, 16V (Disc.)	1502-0503-003
C215	10mf, 20%, 25V (Tantalum)	1515-0100-005
C217	4-40pf MICA Trimmer (38-50 MHz)	1517-0000-009
	4-60pf MICA Trimmer (29-38 MHz)	1517-0000-005
C218	90-400pf, MICA Trimmer	1517-0000-008
C219	470pf, 5%, 500v,MICA (29-32 MHz)	1504-0471-505
	390pf, 5%, 500v,MICA (32-35 MHz)	1504-0391-505
	300pf, 5%, 500v,MICA (35-38 MHz)	1504-0301-505
	270pf, 5%, 500v,MICA (38-41 MHz)	1504-0271-505
	220pf, 5%, 500v,MICA (41-44 MHz)	1504-0221-505
	180pf, 5%, 500v,MICA (44-47 MHz)	1504-0181-505
	150pf, 5%, 500v,MICA (47-50 MHz)	1504-0151-505
C220	390pf, 5%, 500V MICA (29-32 MHz)	1504-0391-505
	360pf, 5%, 500V MICA (32-35 MHz)	1504-0361-505
	300pf, 5%, 500V MICA (35-38 MHz)	1504-0301-505
	250pf, 5%, 500V MICA (38-41 MHz)	1504-0251-505
	200pf, 5%, 500V MICA (41-44 MHz)	1504-0201-505
	180pf, 5%, 500V MICA (44-47 MHz)	1504-0181-505
	150pf, 5%, 500V MICA (47-50 MHz)	1504-0151-505
C221	300pf, 5%, 50v MICA (29-32 MHz)	1506-0301-550
	250pf, 5%, 50v MICA (32-35 MHz)	1506-0251-550
	200pf, 5%, 50v MICA (35-38 MHz)	1506-0201-550
	180pf, 5%, 50v MICA (38-41 MHz)	1506-0181-550
	150pf, 5%, 50v MICA (41-44 MHz)	1506-0151-550
	120pf, 5%, 50v MICA (44-47 MHz)	1506-0121-550
	100pf, 5%, 50v MICA (47-50 MHz)	1506-0101-550
C222	120pf, 5%, 50V MICA (29-32 MHz)	1506-0121-550
	100pf, 5%, 50V MICA (32-35 MHz)	1506-0101-550
	82pf, 5%, 50V MICA (35-38 MHz)	1506-0820-550
	75pf, 5%, 50V MICA (38-41 MHz)	1506-0750-550
	56pf, 5%, 50V MICA (41-47 MHz)	1506-0560-550
	47pf, 5%, 50V MICA (47-50 MHz)	1506-0470-550
C223	100pf, 5%, 50V MICA (29-32 MHz)	1506-0101-550
	82pf, 5%, 50v MICA (32-38 MHz)	1506-0820-550
	56pf, 5%, 50V MICA (38-41 MHz)	1506-0560-550
	47pf, 5%, 50V MICA (41-47 MHz)	1506-0470-550
	36pf, 5%, 50V MICA (47-50 MHz)	1506-0360-550
C224	.01, +80 -20%, 16V (Disc.)	1502-0103-003
C225	220pf, 5%, 50V MICA (29-35 MHz)	1506-0221-550
	150pf, 5%, 50V MICA (35-41 MHz)	1506-0151-550
	100pf, 5%, 50V MICA (41-44 MHz)	1506-0101-550
	82pf, 5%, 50V MICA (44-50 MHz)	1506-0820-550

Item No.	Description	Part No.
	CAPACITORS	
C226	470pf, 5%, 50V MICA (29-35 MHz)	1506-0471-550
	360pf, 5%, 50V MICA (35-50 MHz)	1506-0361-550
C227	150pf, 5%, 50V MICA (29-35 MHz)	1506-0151-550
	100pf, 5%, 50V MICA (35-41 MHz)	1506-0101-550
	82pf, 5%, 50V MICA (41-44 MHz)	1506-0820-550
	75pf, 5%, 50V MICA (44-50 MHz)	1506-0750-550
C228	.01, +80 -20%, 16V (Disc.)	1502-0130-003
C229	360pf, 5%, 50V MICA (29-32 MHz)	1506-0361-550
	300pf, 5%, 50V MICA (32-35 MHz)	1506-0301-550
	270pf, 5%, 50V MICA (35-38 MHz)	1506-0271-550
	250pf, 5%, 50V MICA (38-41 MHz)	1506-0251-550
	220pf, 5%, 50V MICA (41-44 MHz)	1506-0221-550
	180pf, 5%, 50V MICA (44-50 MHz)	1506-0181-550
C230	1000pf, 5%, 50V MICA (29-41 MHz)	1507-0102-004
	470pf, 5%, 50V MICA (41-50 MHz)	1506-0471-550
C231	.005mf, +80 -20%, 500V Z5U (Disc.)	1503-0502-002
C232	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C233	300pf, 5%, 50V MICA (29-32 MHz)	1506-0301-550
	220pf, 5%, 50V MICA (32-38 MHz)	1506-0221-550
	200pf, 5%, 50V MICA (38-41 MHz)	1506-0201-550
	150pf, 5%, 50V MICA (41-44 MHz)	1506-0151-550
	120pf, 5%, 50V MICA (44-50 MHz)	1506-0121-550
C235	680pf, 5%, 50V MICA (29-32 MHz)	1506-0681-550
	560pf, 5%, 50V MICA (32-38 MHz)	1506-0561-550
	390pf, 5%, 50V MICA (38-44 MHz)	1506-0391-550
	220pf, 5%, 50V MICA (44-50 MHz)	1506-0221-550
C236	100pf, 5%, 50V (Mica)	1507-0102-004
C237	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C238	390pf, 5%, 50V MICA (29-32 MHz)	1506-0391-550
	360pf, 5%, 50V MICA (32-38 MHz)	1506-0361-550
	270pf, 5%, 50V MICA (38-44 MHz)	1506-0271-550
	180pf, 5%, 50V MICA (44-50 MHz)	1506-0181-550
C239	.1mf, 20%, 12V (Disc.)	1502-0104-005
C240	27pf, 10%, 500V, NPO (Disc.)	1500-0270-605
C241	5pf, 10%, 500V NPO (Disc.)	1500-0050-905
C242	.1mf, 20%, 12V (Disc.)	1502-0104-005
C243	150pf, 5%, 50V (Mica)	1506-0151-550
C244	Same as C243	
C246	2-18pf, Trimmer	1517-0000-001
C247	39pf, 50v, 5% 00-580	1500-0390-550
*C248	Same as C246	
*C249	Same as C247	
*C250	Same as C246	
*C251	Same as C247	
*C252	Same as C246	
*C253	Same as C247	
C254	4-60pf MICA Trimmer (29-38 MHz)	1517-0000-005
C254	4-40pf, MICA Trimmer (38-50 MHz)	1517-0000-009
C255	47pf, 5%, 500V (Mica)	1504-0470-505
C269	300pf, 5%, 500v MICA (29-38 MHz)	1504-0301-505
	270pf, 5%, 500v MICA (38-41 MHz)	1504-0271-505
	1000pf, 5% 500v MICA (41-44MHz)	1504-0102-505
	180pf, 5%, 500v MICA (44-47 MHz)	1504-0181-505
	150pf, 5%, 500v MICA (47-50 MHz)	1504-0151-505
C270	.001mf, +80 -20%, 50v (DISC)	1503-0102-003
C271	390pf, 5%, 50v MICA (47-50 MHz)	1506-0391-550
	560pf, 5%, 50v MICA (29-47 MHz)	1506-0561-550

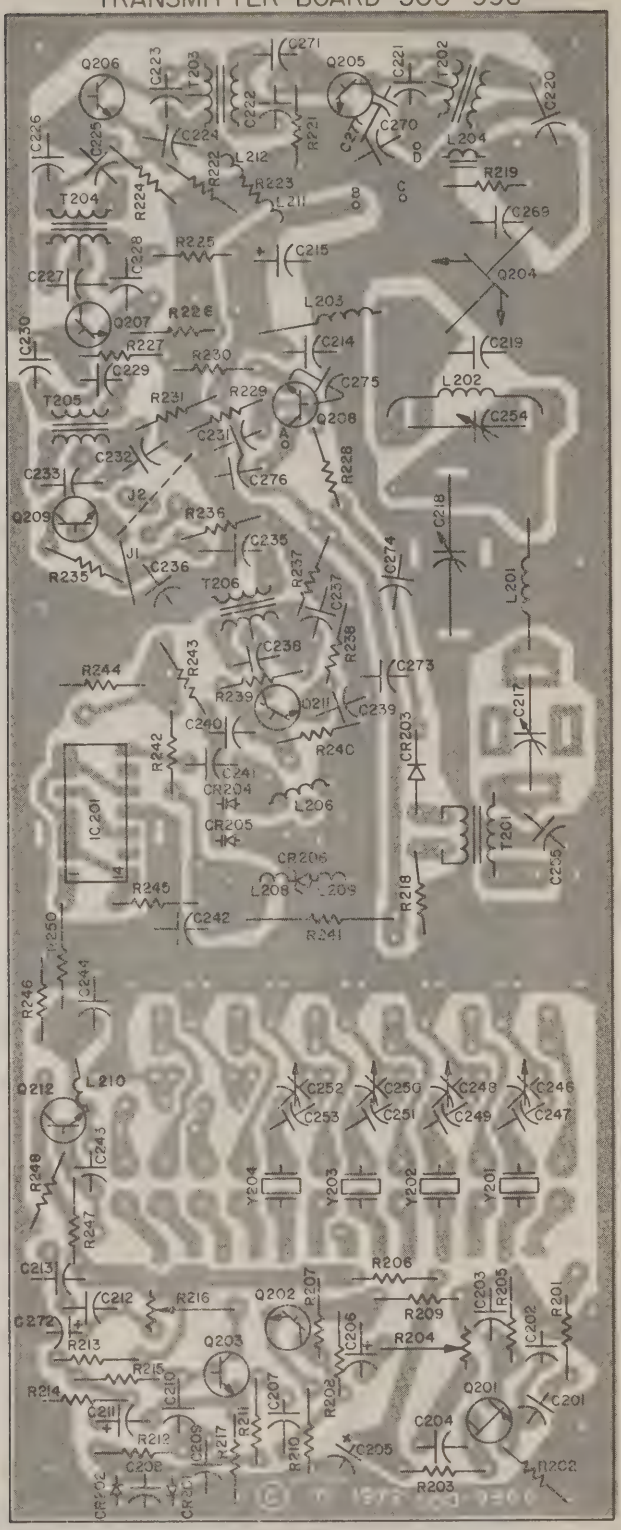
Item No.	Description	Part No.
C272	.0047mf, 10%, 100V (Mylar Film)	1508-0472-610
C273	.01 uf, +80-20%, 50V, YM (Disc.)	1503-0103-007
C274	.01 uf, +80-20%, 50V,YM (Disc.)	1503-0103-007
C275	.01 uf, +80-20%, 50V, YM (Disc.)	1503-0103-007
C276	.01 uf, +80-20%, 50V, YM (Disc.)	1503-0103-007
C277	200pf, 5%, 50v MICA (29-35 MHz)	1506-0201-550
	100pf, 5%, 50v MICA (35-50 MHz)	1506-0101-550
	*Used on BTL-304 ONLY	
	COILS	
L201	Coil Final Output (29-35 MHz)	1801-3240-400
	Coil Final Output (35-41 MHz)	1801-3208-700
	Coil Final Output (41-50 MHz)	1801-3219-600
L202	Coil, Antenna Output (29-41 MHz)	1801-3208-600
	Coil, Antenna Output (41-50 MHz)	1801-1274-201
L203	Coil, RF Choke	1803-3189-800
L204	Choke Bead Coil	1803-1245-900
L206	Coil, Modulator (29-41 MHz)	1800-3189-200
	Coil, Modulator (41-50 MHz)	1800-3208-300
L208	Ferrite Bead	2502-0000-001
L209	Same as L208	
L210	Same as L208	
L211	Same as L208	
L212	Same as L208	
T201	Transformer, SWR Bridge	1800-3190-100
T202	Transformer, Driver (Violet)	1800-3189-701
T203	Transformer (Blue)	1800-3189-601
T204	Transformer (Green)	1800-3189-501
T205	Transformer (Yellow)	1800-3189-401
T206	Transformer (Orange)	1800-3189-301
	TRANSISTORS	
Q201	Junct. FET	4811-0000-030
Q202	Silicon NPN	4801-0000-010
Q203	Same as Q202	
Q204	Silicon, RF Power NPN	4804-3169-503
Q205	Silicon, RF Power NPN	4804-3169-604
Q206	Silicon NPN	4804-0000-015
Q207	Silicon NPN (BT)	4801-0000-003
Q208	Silicon NPN	4801-0000-010
Q209	Silicon NPN (BT)	4801-0000-003
Q211	Silicon NPN (BT)	4801-0000-003
Q212	Same as Q211	
NOTE:	BT=Blue Top	
	INTEGRATED CIRCUITS	
IC201	IC, Divider	3130-3157-607
	Shield, I.C.	2508-1265-900

TRANSMITTER BOARD 500-996

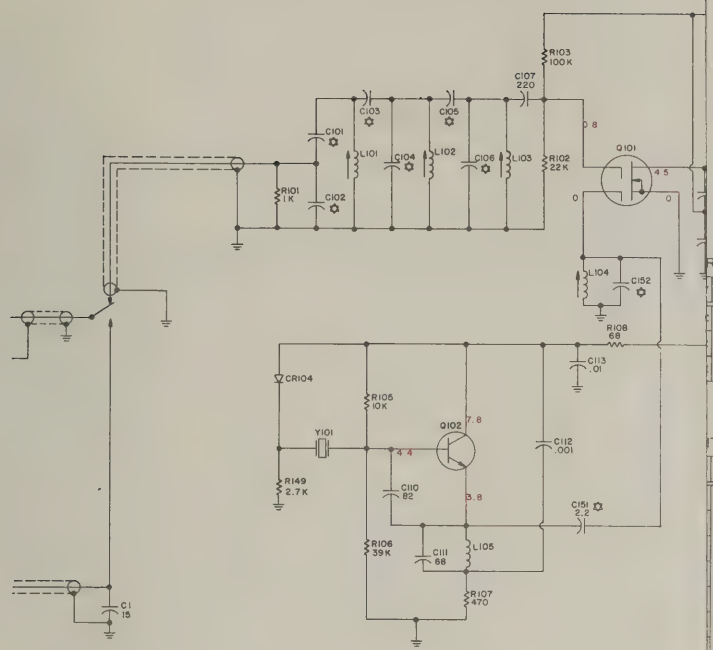


7-3 TRANSMITTER BOARD PARTS PLACEMENT DIAGRAM

TRANSMITTER BOARD 500-996



7-4 TRANSMITTER BOARD PARTS OVERLAY DIAGRAM

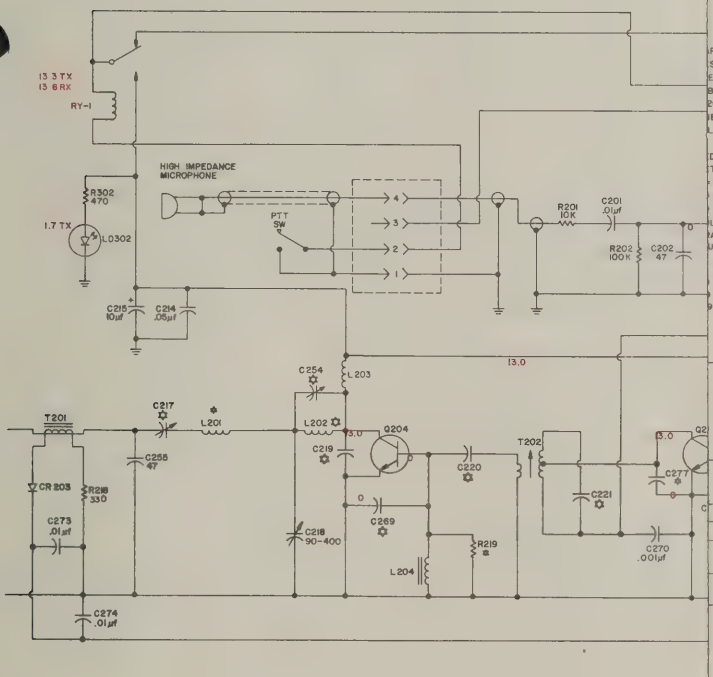


	C101	C102	C103	C104	C105	C106	C151	C152
	33	300	1.2	27	1.2	22	2.7	15
	22	220	1.0	18	.82	12	2.2	10
	15	150	.82	10	.82	8.2	2.2	8.2

ITTER

	C238	C235	C233	C230	C229	C227	C226	C225	C223	C222	C221	C220	C219	C269	L206	L202	C217	C254	C277	C271	R219	R228	L201
	390	680	300	1000	360	150	470	220	100	120	300	390	470	300	301-892	302-086	4-60	4-60	200	560	10	470	302-404
	360	560	220	1000	300	150	470	220	82	100	250	360	390	300	301-892	302-086	4-60	4-60	200	560	10	680	302-404
	360	560	220	1000	270	100	360	150	82	82	200	300	300	300	301-892	302-086	4-60	4-60	100	560	10	820	302-087
	270	390	200	1000	250	100	360	150	56	75	180	250	270	270	301-892	302-086	4-40	4-40	100	560	10	1.5K	302-087
	270	390	150	470	220	82	360	100	47	56	150	200	220	1000	302-083	102-742	4-40	4-40	100	560	10	1.8K	302-196
	180	220	120	470	180	75	360	82	47	56	120	180	180	180	302-083	102-742	4-40	4-40	100	560	10	2.2K	302-196
	180	220	120	470	180	75	360	82	36	47	100	150	150	150	302-083	102-742	4-40	4-40	100	390	15	2.7K	302-196

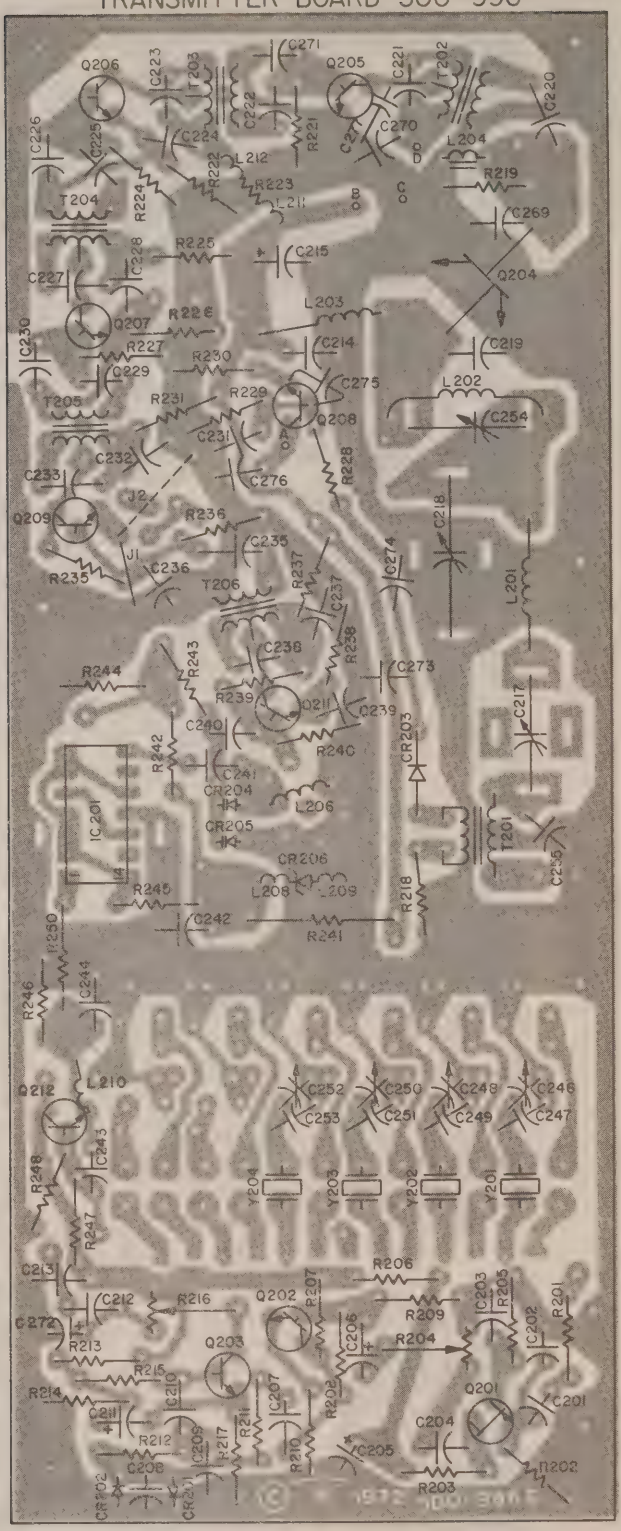
BTL-301



PACITOR VALUES NOT SPECIFIED ARE PICO-FARAD.
SISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT.
ED VALUES ARE FACTORY SELECTED. NOMINAL VALUES SHOWN.
BLES FOR VALUES OF COMPONENTS NOTED ☼.
209, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER
ENT LEADS.
LTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED
VTVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE
D WITH UNIT.
ITTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
UNSQUELCHED
SQUELCHED - THRESHOLD
SQUELCHED - TIGHT
LTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE
ANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.
UMBERS INDICATE LOCATION
CHASSIS MOUNTED
RECEIVER BOARD
TRANSMITTER BOARD
LED DISPLAY BOARD
POWER REGULATOR BOARD

7 - 5 SCHEMATIC WITH VOLTAGES (BTL - 301)

TRANSMITTER BOARD 500-996



7-4 TRANSMITTER BOARD PARTS OVERLAY DIAGRAM

RECEIVER

FREQUENCY	C101	C102	C103	C104	C105	C106	C151	C152
30-35 MHZ	33	300	1.2	27	1.2	22	2.7	15
35-44MHZ	22	220	1.0	18	82	12	2.2	10
44-50 MHZ	15	150	82	10	82	8.2	2.2	8.2

TRANSMITTER

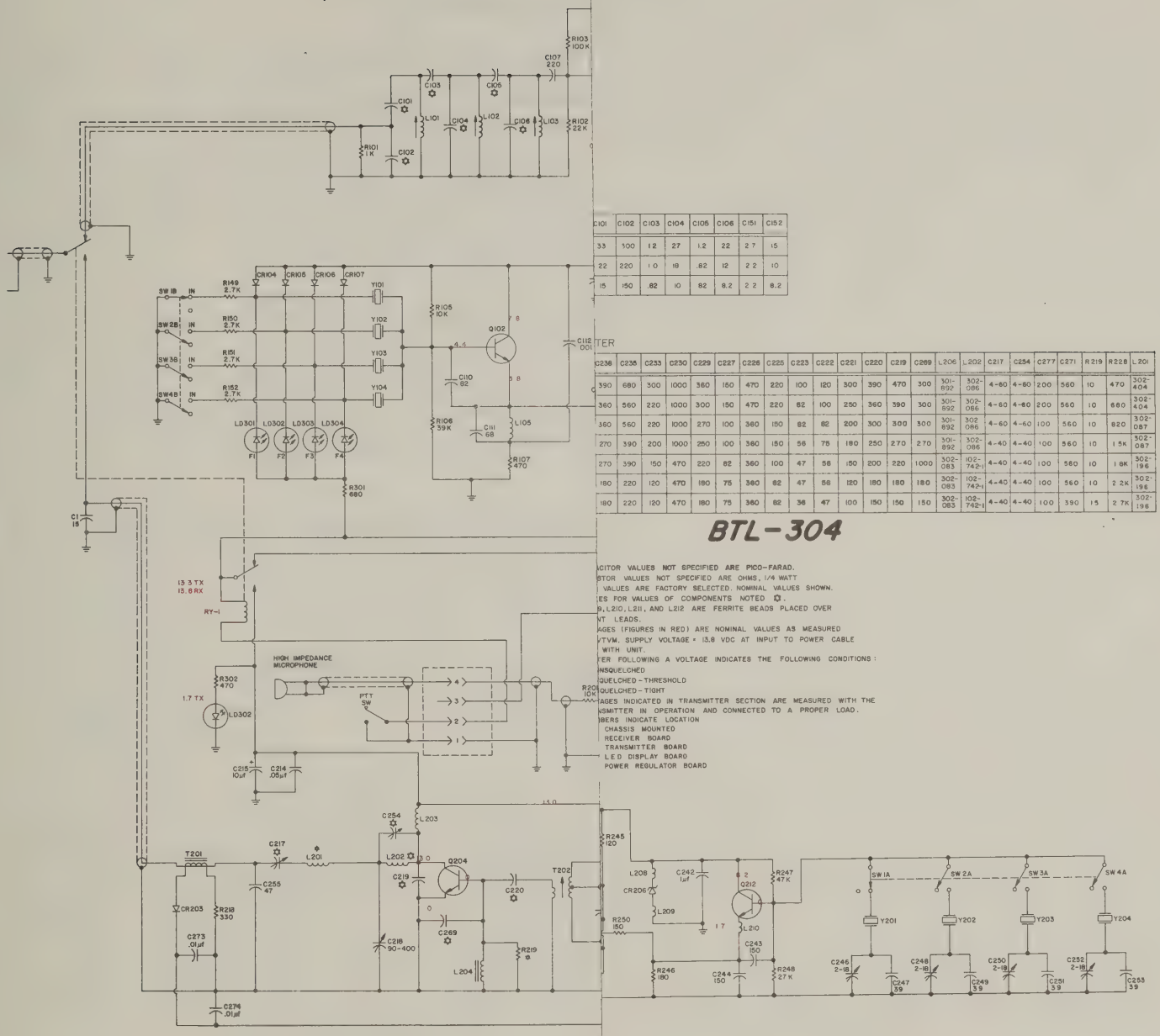
FREQUENCY	C236	C238	C233	C230	C229	C227	C226	C225	C223	C222	C221	C220	C219	C289	L206	L202	C217	C254	C277	C271	R219	R229	L201
29-32 MHZ	390	680	300	1000	360	150	470	220	100	180	300	390	470	300	301-892	302-086	4-60	4-60	200	560	10	470	302-404
32-35 MHZ	360	560	220	1000	300	150	470	220	82	100	250	360	390	300	301-892	302-086	4-60	4-60	200	560	10	680	302-404
35-38 MHZ	360	560	220	1000	270	100	360	150	82	82	200	300	300	300	90-892	302-086	4-60	4-60	100	560	10	820	302-287
38-41 MHZ	270	390	200	1000	250	100	360	150	56	75	180	250	270	270	301-892	302-086	4-40	4-40	100	560	10	1.5K	302-287
41-44 MHZ	270	390	150	470	220	82	360	100	47	56	150	200	220	1000	302-083	302-742	4-40	4-40	100	560	10	1.8K	302-196
44-47 MHZ	180	220	120	470	180	75	360	82	47	56	120	180	180	180	302-083	302-742	4-40	4-40	100	560	10	2.2K	302-196
47-50 MHZ	80	220	120	470	180	75	360	82	56	47	100	150	150	150	302-083	302-742	4-40	4-40	100	390	15	2.7K	302-196

BTL-301

NOTES:

1. ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD.
   ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT
2. △ NOTED VALUES ARE FACTORY SELECTED. NOMINAL VALUES SHOWN
3. SEE TABLES FOR VALUES OF COMPONENTS NOTED ⊡.
4. L208, L209, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER COMPONENT LEADS.
5. ALL VOLTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED WITH A VTVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE SUPPLIED WITH UNIT.
   a. LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
      U = UNSQUELCHED
      S = SQUELCHED - THRESHOLD
      T = SQUELCHED - TIGHT
   b. VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.
6. PART NUMBERS INDICATE LOCATION
   0-99 CHASSIS MOUNTED
   100-199 RECEIVER BOARD
   200-299 TRANSMITTER BOARD
   300-399 LED DISPLAY BOARD
   400-499 POWER REGULATOR BOARD

7 - 5 SCHEMATIC WITH VOLTAGES (BTL - 301)



C101	C102	C103	C104	C105	C106	C151	C152
33	300	12	27	1.2	22	2.7	15
22	220	10	18	.82	12	2.2	10
15	150	.82	10	.82	8.2	2.2	8.2

C238	C235	C233	C230	C229	C227	C226	C225	C223	C222	C221	C220	C219	C269	L206	L202	C217	C254	C277	C271	R219	R228	L201
390	680	300	1000	360	150	470	220	100	120	300	390	470	300	301-892	302-086	4-60	4-60	200	560	10	470	302-404
360	560	220	1000	300	150	470	220	82	100	250	360	390	300	301-892	302-086	4-60	4-60	200	560	10	680	302-404
360	560	220	1000	270	100	360	150	82	82	200	300	300	300	301-892	302-086	4-60	4-60	100	560	10	820	302-087
270	390	200	1000	250	100	360	150	56	75	180	250	270	270	301-892	302-086	4-40	4-40	100	560	10	1.5K	302-087
270	390	150	470	220	82	360	100	47	56	150	200	220	1000	302-083	102-742-1	4-40	4-40	100	560	10	1.8K	302-196
180	220	120	470	180	75	360	82	47	56	120	180	180	180	302-083	102-742-1	4-40	4-40	100	560	10	2.2K	302-196
180	220	120	470	180	75	360	82	36	47	100	150	150	150	302-083	102-742-1	4-40	4-40	100	390	15	2.7K	302-196

CITOR VALUES NOT SPECIFIED ARE PICO-FARAD.
STOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT
VALUES ARE FACTORY SELECTED. NOMINAL VALUES SHOWN.
ES FOR VALUES OF COMPONENTS NOTED ✡.
9, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER
NT LEADS.
AGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED
TVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE
WITH UNIT.
ER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
NSQUELCHED
QUELCHED - THRESHOLD
QUELCHED - TIGHT
AGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE
SMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.
BERS INDICATE LOCATION
CHASSIS MOUNTED
RECEIVER BOARD
TRANSMITTER BOARD
LED DISPLAY BOARD
POWER REGULATOR BOARD

7 - 6 SCHEMATIC WITH VOLTAGES (BTL - 304)

RECEIVER

FREQUENCY	C101	C102	C103	C104	C105	C106	C151	C152
30-36 MHZ	33	300	L2	27	L2	22	2.7	15
36-44MHZ	22	220	1.0	18	.82	12	2.2	10
44-50MHZ	15	50	82	10	82	6.2	2.2	8.2

TRANSMITTER

FREQUENCY	C238	C236	C233	C230	C229	C227	C226	C225	C223	C222	C221	C220	C219	C269	L206	L202	C217	C254	C277	C27	R219	R228	L201
29-32MHZ	390	680	300	1000	360	50	470	220	100	22C	300	390	470	300	10 892	102 86	4-60	4-60	200	560	10	470	302 404
32-36MHZ	360	560	220	1000	300	50	470	220	82	100	250	360	390	300	10 892	102 086	4-60	4-60	200	560	10	680	302 404
36-38 MHZ	360	560	220	1000	270	100	360	150	82	82	200	300	300	300	30 892	102 086	4-60	4-60	100	560	10	820	302 087
38-41 MHZ	270	390	200	1000	250	100	360	150	56	75	180	250	270	270	10 892	102 086	4-40	4-40	100	560	10	1.5K	302 087
41-44 MHZ	270	390	150	470	220	82	360	100	47	56	50	200	220	1000	1029 083	102 742H	4-40	4-40	100	560	10	1 BK	302 196
44-47MHZ	180	220	120	470	180	75	360	82	47	56	180	180	180	180	302 083	102 742H	4-40	4-40	100	560	10	2.2K	302 196
47-50MHZ	180	220	120	470	180	75	380	82	36	47	100	150	150	150	302 083	102 742H	4-40	4-40	100	390	15	2.7K	302 196

BTL-304

NOTES:

1. ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD
   ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT
2. △ NOTED VALUES ARE FACTORY SELECTED NOMINAL VALUES SHOWN
3. SEE TABLES FOR VALUES OF COMPONENTS NOTED ☆.
4. L208, L209, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER COMPONENT LEADS.
5. ALL VOLTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED WITH A VTVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE SUPPLIED WITH UNIT
   a. LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS
      U = UNSQUELCHED
      S = SQUELCHED - THRESHOLD
      T = SQUELCHED - TIGHT
   b. VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD
6. PART NUMBERS INDICATE LOCATION
   0-99 CHASSIS MOUNTED
   100-199 RECEIVER BOARD
   200-299 TRANSMITTER BOARD
   300-399 LED DISPLAY BOARD
   400-499 POWER REGULATOR BOARD

7 - 6 SCHEMATIC WITH VOLTAGES (BTL - 304)

SECTION 8 SERVICE MANUAL ADDENDUM

The following modifications now exist in the BTL-301 and BTL-304 VHF FM Transceivers. The revisions pertain to the Transmitter Board 501-183 on which the power regulator components are now located. Effective April, 1975.

ADDENDUM CONTENTS

8-1 CROSS REFERENCE TO POWER REGULATOR BOARD

This manual revision reflects the relocation of the power regulator circuit on the transmitter board. The circuit is the same as shown in Section 6. Below is a cross reference listing the new circuit symbols.

POWER REGULATOR BOARD 302-342 PARTS LIST			CROSS REFERENCE 501-183 TRANSMITTER BOARD Item #
Item No.	Description	Part No.	
	RESISTORS		
R401	3.3K 10% ¼W	4701-0332-042	R251
R402	150 ohms 10% ½W	4701-0151-044	R252
R403	150 ohms 10% ½W	4701-0151-044	R253
	CAPACITORS		
C401	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007	C278
C402	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007	C279
C403	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007	C280
C404	10 uf 20% 25V TANT	1515-0100-005	C281
C405	150 pf 20% 50V Z5F	1523-0151-002	C282
C406	10 uf 20% 25V TANT	1515-0100-005	C283
C407	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007	C284
C408	10 uf 20% 25V TANT	1515-0100-005	C285
	TRANSISTORS		
Q401	Silicon SPS 952	4801-0000-010	Q210
Q402	Silicon Power PNP SJE 1608	4802-0000-003	Q213

All tuning procedures remain as described in Section 7 and 6. This section contains transmitter board and receiver board parts placement diagrams with wire tie points cross referenced to the schematic diagrams.

RESISTORS

All Resistors are ±10%, ¼W, unless otherwise noted.

Item No.	Description	Part No.
R201	10K	
R202	100K	
R203	10K	
R204	Trimmer, 10K	4751-0103-001
R205	3.9K	
R206	2.7K	
R207	6.8K	
R208	68K	
R209	18K	
R210	470 ohm	
R211	10K	
R212	39K	
R213	120K	
R214	27K	
R215	39K	
R216	Trimmer, 10K	4751-0103-001
R217	470 ohm	
R218	330 ohm, 5%	
R219	10 ohm (29-47 MHz) 15 ohm (47-50 MHz)	
R220	3.3 ohm	4701-0339-042
R221	18 ohm	
R222	10 ohm	
R223	10 ohm	
R224	22 ohm	
R225	100 ohm	
R226	47 ohm	
R227	270 ohm	
R228	470 ohm (29-32 MHz) 680 ohm (32-35 MHz) 820 ohm (35-38 MHz) 1.5K ohm (38-41 MHz) 1.8K ohm (41-44 MHz) 2.2K ohm (44-47 MHz) 2.7K ohm (47-50 MHz)	
R229	1.5K	
R230	10 ohm	
R231	100 ohm	
R235	82K	
R236	4.7K	
R237	100 ohm	
R238	150 ohm	
R239	27K	
R240	2.7K	
R241	100 ohm, 1W, 10%	4701-0101-042
R242	100K	
R243	68K	
R244	100K	
R245	120 ohm	
R246	180 ohm	
R247	47K	
R248	27K	
R250	150 ohm	
R251	3.3K	
R252	150 ohm, ½W 10%	4701-0151-044
R253	150 ohm, ½W 10%	4701-0151-044

CAPACITORS

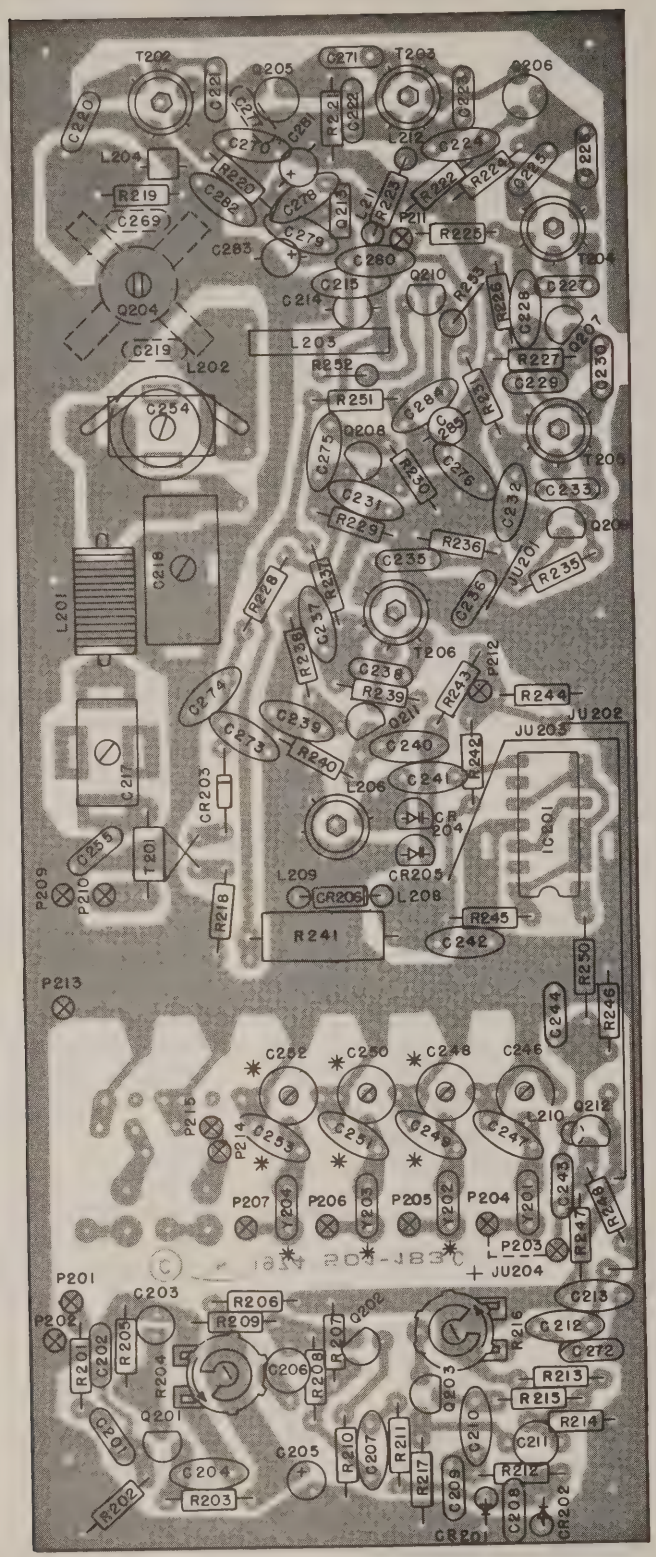
Item No.	Description	Part No.
C201	.01mf, 10%, 100V (Mylar Film)	1508-0103-610
C202	47pf, 5%, 50V (Mica)	1507-0470-001
C203	10mf, 85°C, 10V (Electrolytic)	1513-0100-001
C204	.1mf, 20%, 12V (Disc.)	1502-0104-005
C205	25mf, 85°C, 10V (Electrolytic)	1513-0250-001
C206	.47mf, +80 -20%, 3V (Disc.)	1502-0474-001
C207	.1mf, 20%, 12V (Disc.)	1502-0104-005
C208	.0033mf, 10%, 100V (Mylar Film)	1508-0332-610
C209	.022mf, 10%, 100V (Mylar Film)	1508-0223-610
C210	.1mf, 20%, 12V (Disc.)	1502-0104-005
C211	.47mf, +80 -20%, 3V (Disc.)	1502-0474-001
C212	.1mf, 20%, 12V (Disc.)	1502-0104-005
C213	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C214	.05mf, +80 -20%, 16V (Disc.)	1502-0503-003
C215	10mf, 20%, 25V (Tantalum)	1515-0100-005
C217	4-40pf MICA Trimmer (38-50 MHz)	1517-0000-009
	4-60pf MICA Trimmer (29-38 MHz)	1517-0000-005
C218	90-400pf, MICA Trimmer	1517-0000-008
C219	470pf, 5%, 500v,MICA (29-32 MHz)	1504-0471-505
	390pf, 5%, 500v,MICA (32-35 MHz)	1504-0391-505
	300pf, 5%, 500v,MICA (35-38 MHz)	1504-0301-505
	270pf, 5%, 500v,MICA (38-41 MHz)	1504-0271-505
	220pf, 5%, 500v,MICA (41-44 MHz)	1504-0221-505
	180pf, 5%, 500v,MICA (44-47 MHz)	1504-0181-505
	150pf, 5%, 500v,MICA (47-50 MHz)	1504-0151-505
C220	390pf, 5%, 500V MICA (29-32 MHz)	1504-0391-505
	360pf, 5%, 500V MICA (32-35 MHz)	1504-0361-505
	300pf, 5%, 500V MICA (35-38 MHz)	1504-0301-505
	250pf, 5%, 500V MICA (38-41 MHz)	1504-0251-505
	200pf, 5%, 500V MICA (41-44 MHz)	1504-0201-505
	180pf, 5%, 500V MICA (44-47 MHz)	1504-0181-505
	150pf, 5%, 500V MICA (47-50 MHz)	1504-0151-505
C221	300pf, 5%, 50v MICA (29-32 MHz)	1506-0301-550
	250pf, 5%, 50v MICA (32-35 MHz)	1506-0251-550
	200pf, 5%, 50v MICA (35-38 MHz)	1506-0201-550
	180pf, 5%, 50v MICA (38-41 MHz)	1506-0181-550
	150pf, 5%, 50v MICA (41-44 MHz)	1506-0151-550
	120pf, 5%, 50v MICA (44-47 MHz)	1506-0121-550
	100pf, 5%, 50v MICA (47-50 MHz)	1506-0101-550
C222	120pf, 5%, 50V MICA (29-32 MHz)	1506-0121-550
	100pf, 5%, 50V MICA (32-35 MHz)	1506-0101-550
	82pf, 5%, 50V MICA (35-38 MHz)	1506-0820-550
	75pf, 5%, 50V MICA (38-41 MHz)	1506-0750-550
	56pf, 5%, 50V MICA (41-47 MHz)	1506-0560-550
	47pf, 5%, 50V MICA (47-50 MHz)	1506-0470-550
C223	100pf, 5%, 50V MICA (29-32 MHz)	1506-0101-550
	82pf, 5%, 50v MICA (32-38 MHz)	1506-0820-550
	56pf, 5%, 50V MICA (38-41 MHz)	1506-0560-550
	47pf, 5%, 50V MICA (41-47 MHz)	1506-0470-550
	36pf, 5%, 50V MICA (47-50 MHz)	1506-0360-550
C224	.01, +80 -20%, 16V (Disc.)	1502-0103-003
C225	220pf, 5%, 50V MICA (29-35 MHz)	1506-0221-550
	150pf, 5%, 50V MICA (35-41 MHz)	1506-0151-550
	100pf, 5%, 50V MICA (41-44 MHz)	1506-0101-550
	82pf, 5%, 50V MICA (44-50 MHz)	1506-0820-550

Item No.	Description	Part No.
	CAPACITORS	
C226	470pf, 5%, 50V MICA (29-35 MHz)	1506-0471-550
	360pf, 5%, 50V MICA (35-50 MHz)	1506-0361-550
C227	150pf, 5%, 50V MICA (29-35 MHz)	1506-0151-550
	100pf, 5%, 50V MICA (35-41 MHz)	1506-0101-550
	82pf, 5%, 50V MICA (41-44 MHz)	1506-0820-550
	75pf, 5%, 50V MICA (44-50 MHz)	1506-0750-550
C228	.01, +80 -20%, 16V (Disc.)	1502-0130-003
C229	360pf, 5%, 50V MICA (29-32 MHz)	1506-0361-550
	300pf, 5%, 50V MICA (32-35 MHz)	1506-0301-550
	270pf, 5%, 50V MICA (35-38 MHz)	1506-0271-550
	250pf, 5%, 50V MICA (38-41 MHz)	1506-0251-550
	220pf, 5%, 50V MICA (41-44 MHz)	1506-0221-550
	180pf, 5%, 50V MICA (44-50 MHz)	1506-0181-550
C230	1000pf, 5%, 50V MICA (29-41 MHz)	1507-0102-004
	470pf, 5%, 50V MICA (41-50 MHz)	1506-0471-550
C231	.005mf, +80 -20%, 500V Z5U (Disc.)	1503-0502-002
C232	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C233	300pf, 5%, 50V MICA (29-32 MHz)	1506-0301-550
	220pf, 5%, 50V MICA (32-38 MHz)	1506-0221-550
	200pf, 5%, 50V MICA (38-41 MHz)	1506-0201-550
	150pf, 5%, 50V MICA (41-44 MHz)	1506-0151-550
	120pf, 5%, 50V MICA (44-50 MHz)	1506-0121-550
C235	680pf, 5%, 50V MICA (29-32 MHz)	1506-0681-550
	560pf, 5%, 50V MICA (32-38 MHz)	1506-0561-550
	390pf, 5%, 50V MICA (38-44 MHz)	1506-0391-550
	220pf, 5%, 50V MICA (44-50 MHz)	1506-0221-550
C236	1000pf, 5%, 50v (Mica)	1507-0102-004
C237	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C238	390pf, 5%, 50V MICA (29-32 MHz)	1506-0391-550
	360pf, 5%, 50V MICA (32-38 MHz)	1506-0361-550
	270pf, 5%, 50V MICA (38-44 MHz)	1506-0271-550
	180pf, 5%, 50V MICA (44-50 MHz)	1506-0181-550
C239	.1mf, 20%, 12V (Disc.)	1502-0104-005
C240	27pf, 10%, 500V, NPO (Disc.)	1500-0270-605
C241	5pf, 10%, 500V NPO (Disc.)	1500-0050-905
C242	.1mf, 20%, 12V (Disc.)	1502-0104-005
C243	150pf, 5%, 50V (Mica)	1506-0151-550
C244	Same as C243	
C246	2-18pf, Trimmer	1517-0000-001
C247	39pf, 50v, 5% 00-580	1500-0390-550
*C248	Same as C246	
*C249	Same as C247	
*C250	Same as C246	
*C251	Same as C247	
*C252	Same as C246	
*C253	Same as C247	
C254	4-60pf MICA Trimmer (29-38 MHz)	1517-0000-005
C254	4-40pf, MICA Trimmer (38-50 MHz)	1517-0000-009
C255	47pf, 5%, 500V (Mica)	1504-0470-505
C269	300pf, 5%, 500v MICA (29-38 MHz)	1504-0301-505
	270pf, 5%, 500v MICA (38-41 MHz)	1504-0271-505
	1000pf, 5% 500v MICA (41-44MHz)	1504-0102-505
	180pf, 5%, 500v MICA (44-47 MHz)	1504-0181-505
	150pf, 5%, 500v MICA (47-50 MHz)	1504-0151-505
C270	1000pf, 5%, 500v (Mica)	1504-0102-505
C271	390pf, 5%, 50v MICA (47-50 MHz)	1506-0391-550
	560pf, 5%, 50v MICA (29-47 MHz)	1506-0561-550

Item No.	Description	Part No.
C272	.0047mf, 10%, 100V (Mylar Film)	1508-0472-610
C273	.01 uf, +80-20%, 50V, YM (Disc.)	1503-0103-007
C274	.01 uf, +80-20%, 50V,YM (Disc.)	1503-0103-007
C275	.01 uf, +80-20%, 50V, YM (Disc.)	1503-0103-007
C276	.01 uf, +80-20%, 50V, YM (Disc.)	1503-0103-007
C277	200pf, 5%, 50v MICA (29-35 MHz)	1506-0201-550
	100pf, 5%, 50v MICA (35-50 MHz)	1506-0101-550
C278	.01vf +80 -20% 50v YM (Disc)	1503-0103-007
C279	.01vf +80 -20% 50v YM (Disc)	1503-0103-007
C280	.01vf +80 -20% 50v YM (Disc)	1503-0103-007
C281	10vf 20% 25v Tant	1515-0100-005
C282	150vf 20% 50v 25F	1513-0151-002
C283	10vf 20% 25v Tant	1515-0100-005
C284	.01vf +80 -20% 50v YM (Disc)	1503-0103-007
C285	10vf 20% 25v Tant	1515-0100-005
	*Used on BTL-304 ONLY	
	COILS	
L201	Coil Final Output (29-35 MHz)	1801-3240-400
	Coil Final Output (35-41 MHz)	1801-3208-700
	Coil Final Output (41-50 MHz)	1801-3219-600
L202	Coil, Antenna Output (29-41 MHz)	1801-3208-600
	Coil, Antenna Output (41-50 MHz)	1801-1274-201
L203	Coil, RF Choke	1803-3189-800
L204	Choke Bead Coil	1803-1245-900
L206	Coil, Modulator (29-32 MHz)	1800-3249-000
	Coil, Modulator (32-41 MHz)	1800-3189-200
	Coil, Modulator (41-50 MHz)	1800-3208-300
L208	Ferrite Bead	2502-0000-001
L209	Same as L208	
L210	Same as L208	
L211	Same as L208	
L212	Same as L208	
T201	Transformer, SWR Bridge	1800-3190-100
T202	Transformer, Driver (Violet)	1800-3189-701
T203	Transformer (Blue)	1800-3189-601
T204	Transformer (Green)	1800-3189-501
T205	Transformer (Yellow)	1800-3189-401
T206	Transformer (Orange)	1800-3189-301
	TRANSISTORS	
Q201	Junct. FET	4811-0000-030
Q202	Silicon NPN	4801-0000-010
Q203	Same as Q202	
Q204	Silicon, RF Power NPN	4804-3169-503
Q205	Silicon, RF Power NPN	4804-3169-604
Q206	Silicon NPN	4804-0000-015
Q207	Silicon NPN (BT)	4801-0000-003
Q208	Silicon NPN	4801-0000-010
Q209	Silicon NPN (BT)	4801-0000-003
Q210	Silicon NPN	4801-0000-010
Q211	Silicon NPN (BT)	4801-0000-003
Q212	Same as Q211	
Q213	Silicon PNP	4802-0000-003
NOTE:	BT=Blue Top	
	INTEGRATED CIRCUITS	
IC201	IC, Divider	3130-3157-607
	Shield, I.C.	2508-1265-900

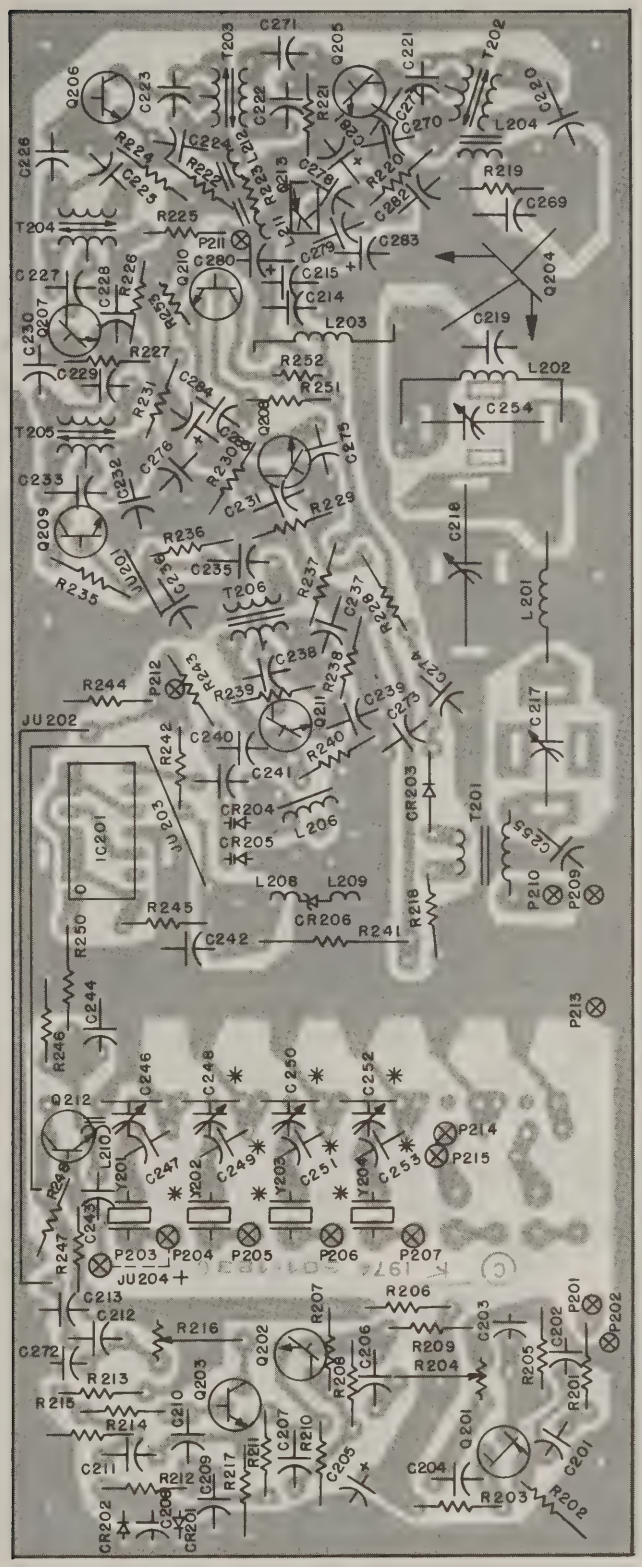
TRANSMITTER BOARD 501-183

* SYMBOL INDICATES USED IN BTL-304 ONLY
+ SYMBOL INDICATES USED IN BTL-301 AND BTL-301T



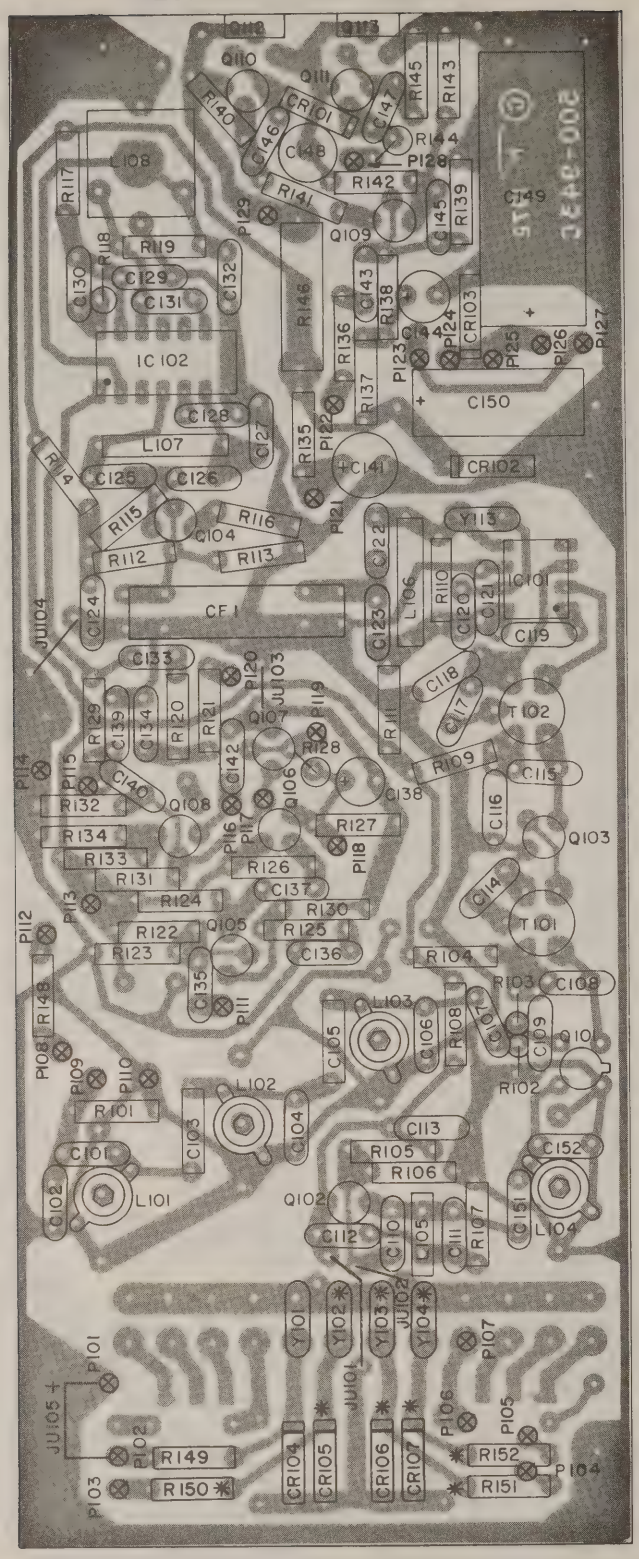
8-3 TRANSMITTER BOARD PARTS PLACEMENT DIAGRAM

TRANSMITTER BOARD – 501-183



8-4 TRANSMITTER BOARD PARTS OVERLAY DIAGRAM

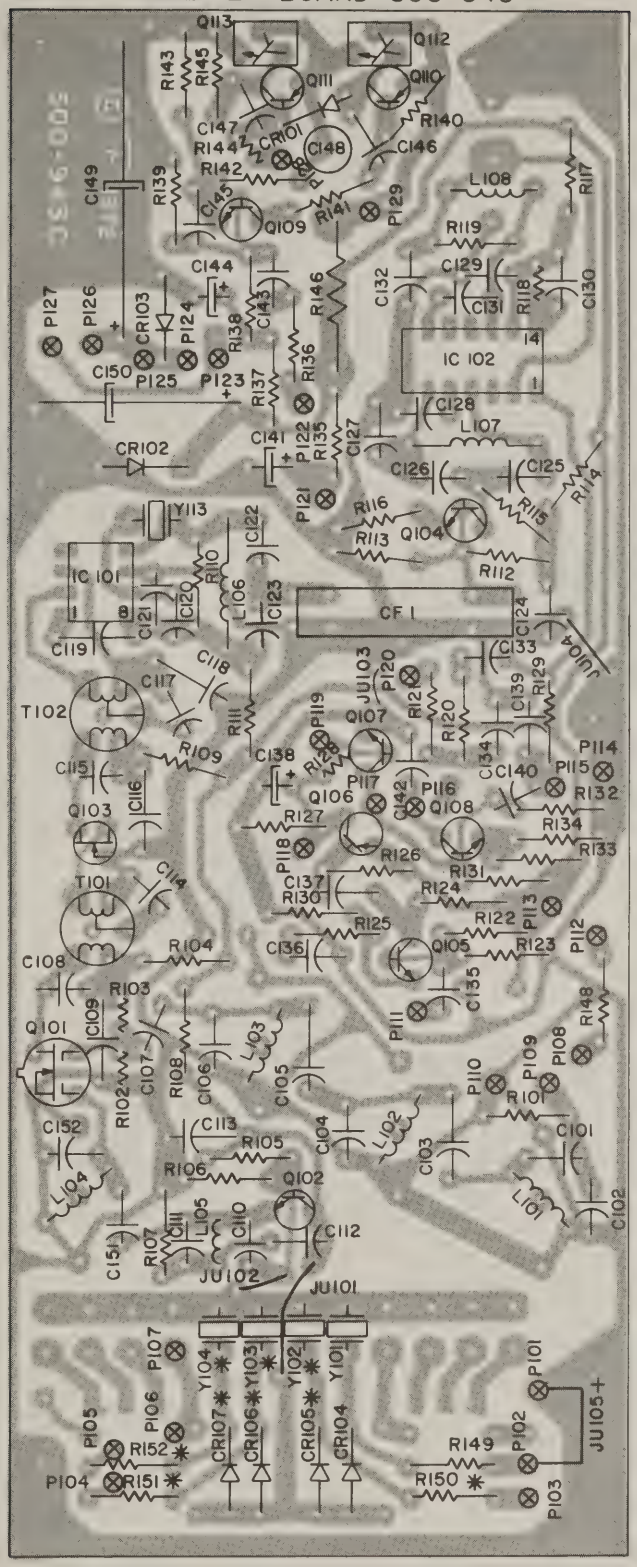
RECEIVER BOARD 500-943



* SYMBOL INDICATES USED IN BTL-304 ONLY
+ SYMBOL INDICATES USED IN BTL-301 AND BTL-301T

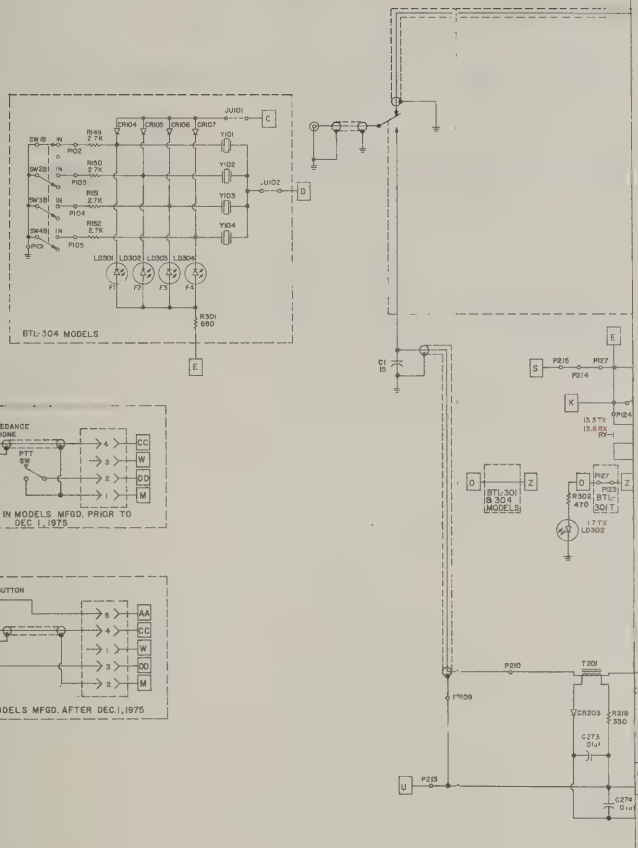
8-5 RECEIVER BOARD PARTS PLACEMENT DIAGRAM

RECEIVER BOARD 500-943



* SYMBOL INDICATES USED IN BTL-304 ONLY
\+ SYMBOL INDICATES USED IN BTL-301 AND BTL-301T

8-6 RECEIVER BOARD PARTS OVERLAY DIAGRAM



RECEIVER

FREQUENCY	C101	C102	C103	C104	C105	C106	C151	C152
30-35MHZ	33	300	1.2	27	1.2	22	2.7	15
35-44MHZ	22	220	1.0	18	.82	12	2.2	10
44-50MHZ	15	150	82	10	82	9.2	2.2	8.2

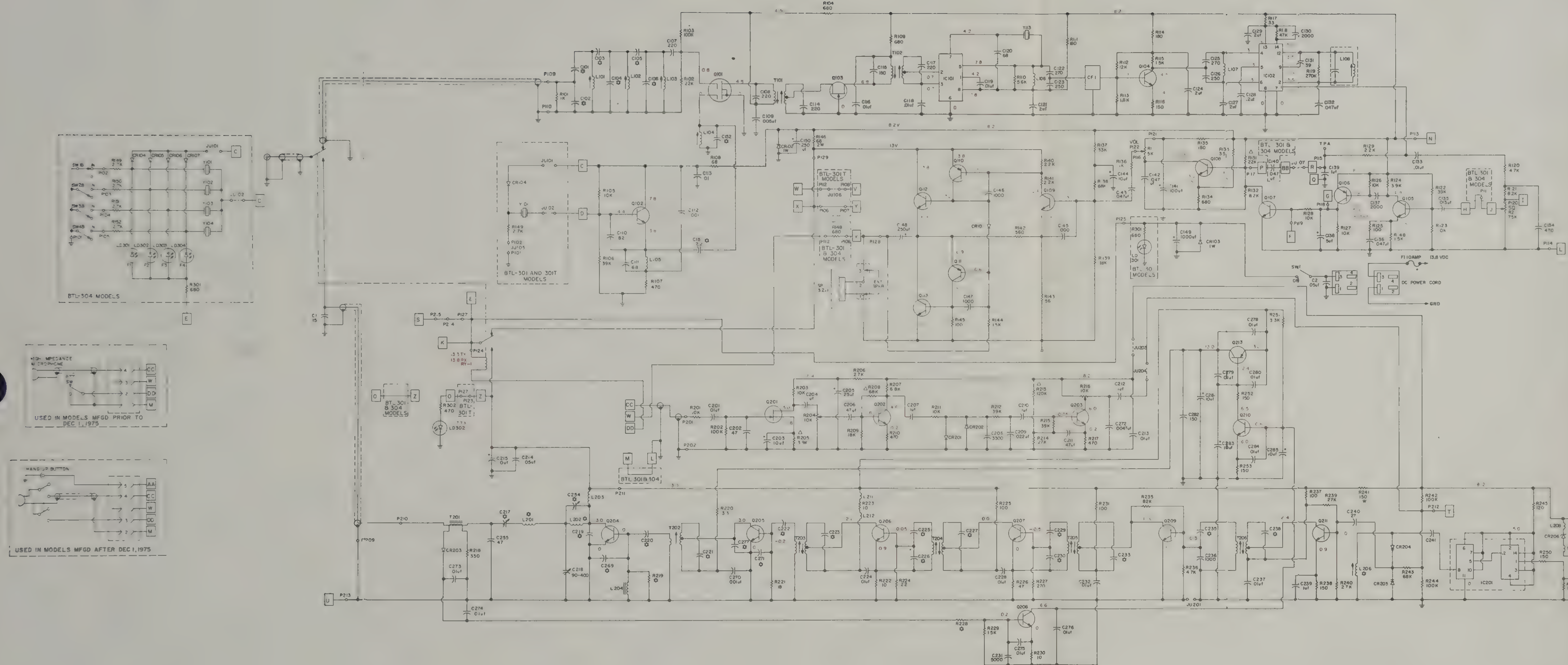
TRANSMITTER

FREQUENCY	C238	C235	C233	C230	C229	C227	C226	C225	C223	C222	C221	C220	C219	C259	L206	L202	C217	C254	C277	C271	R219	R228	L601
29-32MHZ	390	680	300	1000	360	150	470	220	100	120	300	390	470	300	302-400	302-088	4-60	4-60	200	560	10	470	302-404
32-35MHZ	360	560	220	1000	300	150	470	220	82	100	250	360	390	300	301-892	302-086	4-60	4-60	200	560	10	680	302-404
35-38MHZ	360	560	220	1000	270	100	360	150	82	82	200	300	300	300	301-892	302-086	4-60	4-60	100	560	10	920	302-087
38-41MHZ	270	390	200	1000	250	100	360	150	56	75	180	250	270	270	301-892	302-086	4-40	4-40	100	560	10	5K	302-087
41-44 MHZ	270	390	150	470	220	82	360	100	47	56	150	200	220	1000	302-083	102-742-1	4-40	4-40	100	560	10	1.8K	302-196
44-47MHZ	180	220	120	470	180	75	360	82	47	56	120	180	180	180	302-083	102-742-1	4-40	4-40	100	560	10	2.2K	302-196
47-50MHZ	180	220	120	470	180	75	360	82	36	47	100	150	150	150	302-083	102-742-1	4-40	4-40	100	390	15	2.7K	302-196

NOTES:
1. ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD.
   ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT.
2. △ NOTED VALUES ARE FACTORY SELECTED. NOMINAL VALUES SHOWN
3. SEE TABLES FOR VALUES OF COMPONENTS NOTED ✡
4. L206, L209, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER COMPONENT LEADS.
5. ALL VOLTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED WITH A VTVM. SUPPLY VOLTAGE= 13.8 VDC AT INPUT TO POWER CABLE SUPPLIED WITH UNIT.
   a. LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS
      U= UNSQUELCHED
      S= SQUELCHED—THRESHOLD
      T= SQUELCHED—TIGHT
   b. VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD
6. PART NUMBERS INDICATE LOCATION
   0-99 CHASSIS MOUNTED
   100-199 RECEIVER BOARD
   200-299 TRANSMITTER BOARD
   300-399 LED DISPLAY BOARD

8-7 SCHEMATIC WITH VOLTAGES

BTL-300 SERIES



RECEIVER

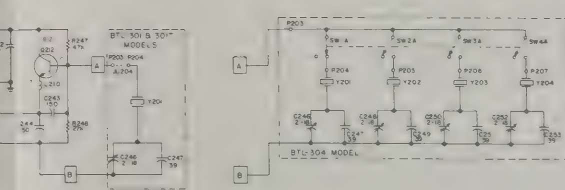
FREQUENCY	C101	C102	C103	C104	C106	C108	C151	C152
30-36MHZ	33	300	[illegible]	27	[illegible]	22	2.7	5
36-44MHZ	22	220	[illegible]	8	82	[illegible]	2.2	[illegible]
44-50MHZ	15	150	82	10	82	8.2	2.2	8.2

TRANSMITTER

FREQUENCY	C236	C235	C232	C230	C229	C227	C226	C225	C223	C222	[illegible]	C220	C219	C265	[illegible]	[illegible]	[illegible]	C254	[illegible]	[illegible]	R219	R228	[illegible]
29-32MHZ	390	680	300	1000	360	50	470	220	[illegible]	[illegible]	300	390	470	300	302-490	302-086	4-60	4-60	200	560	10	470	302-404
32-35MHZ	360	560	220	1000	300	50	470	220	82	100	250	360	390	300	301-892	302-086	4-60	4-60	200	390	[illegible]	680	302-404
35-38MHZ	360	560	220	1000	270	100	360	50	82	82	200	300	300	300	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	560	[illegible]	820	[illegible]
38-41MHZ	270	390	200	1000	250	100	360	150	56	75	80	250	270	270	[illegible]	[illegible]	4-40	4-40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
41-44MHZ	270	390	[illegible]	[illegible]	[illegible]	82	360	100	47	56	150	200	220	1000	302-083	[illegible]	4-40	4-40	[illegible]	56	[illegible]	[illegible]	[illegible]
44-47MHZ	180	220	120	470	80	75	360	82	47	56	120	80	180	[illegible]	[illegible]	[illegible]	4-40	4-40	100	560	[illegible]	2.2K	[illegible]
47-50MHZ	180	220	120	470	180	75	360	82	36	47	100	50	150	50	302-083	[illegible]	4-40	4-40	100	390	15	2.7K	302-96

NOTES:

1. ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD
   ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS 1/4 WATT
2. △ NOTED VALUES ARE FACTORY SELECTED NOMINAL VALUES SHOWN
3. SEE TABLES FOR VALUES OF COMPONENTS NOTED ⚙
4. L208, L209, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER COMPONENT LEADS
5. ALL VOLTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED WITH A VTVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE SUPPLIED WITH UNIT
   a. LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS
      U = UNSQUELCHED
      S = SQUELCHED—THRESHOLD
      T = SQUELCHED—TIGHT
   b. VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD
6. PART NUMBERS INDICATE LOCATION
   [illegible] CHASSIS MOUNTED
   100-199 RECEIVER BOARD
   200-299 TRANSMITTER BOARD
   300-399 LED DISPLAY BOARD



8-7 SCHEMATIC WITH VOLTAGES

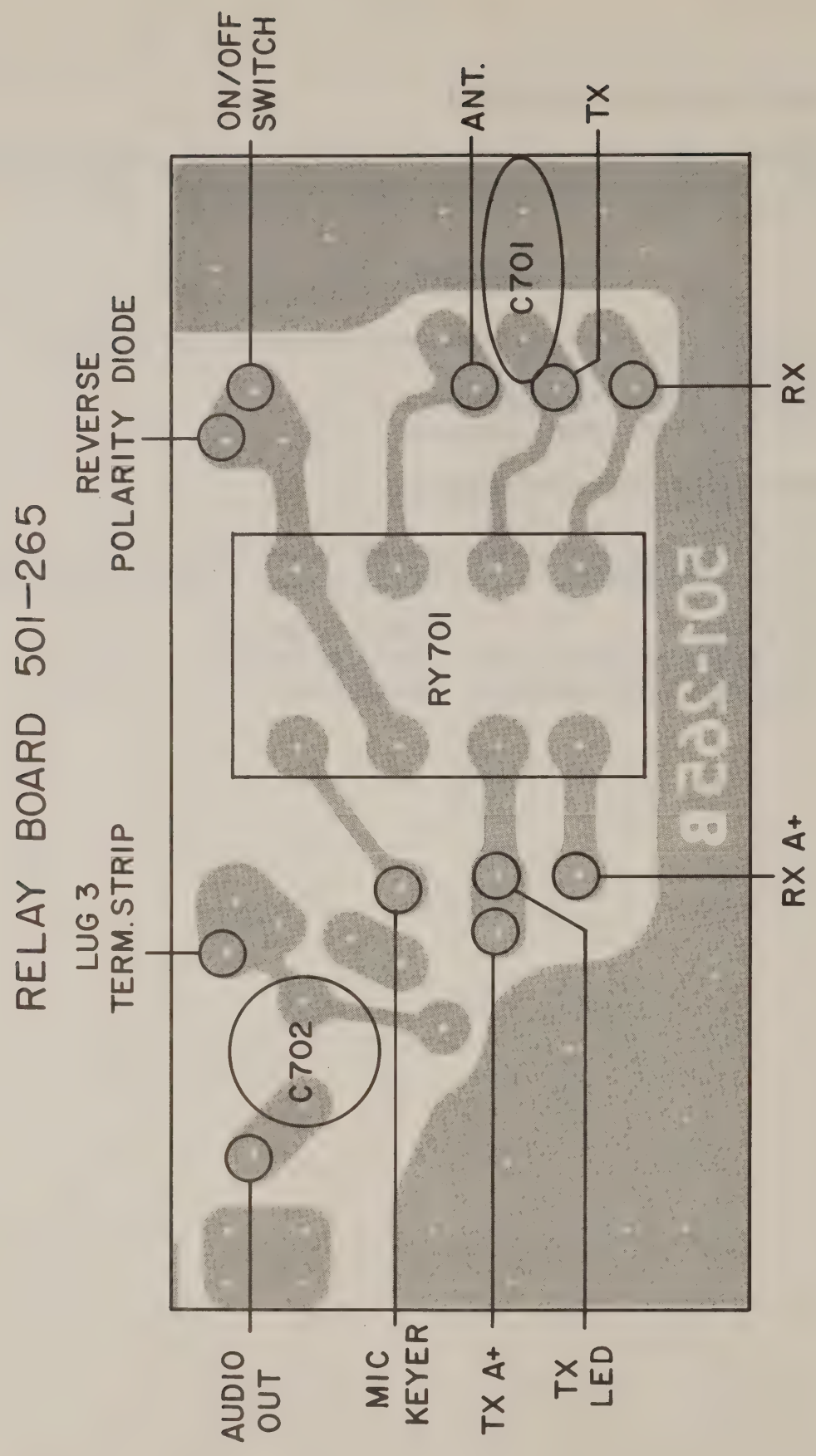
SECTION 9 SERVICE MANUAL ADDENDUM

The following modifications now exist in the BTL-301 and BTL-304 VHF FM Transceivers. The revisions pertain to the Relay Board 501-265. Effective December, 1975.

CONTENTS

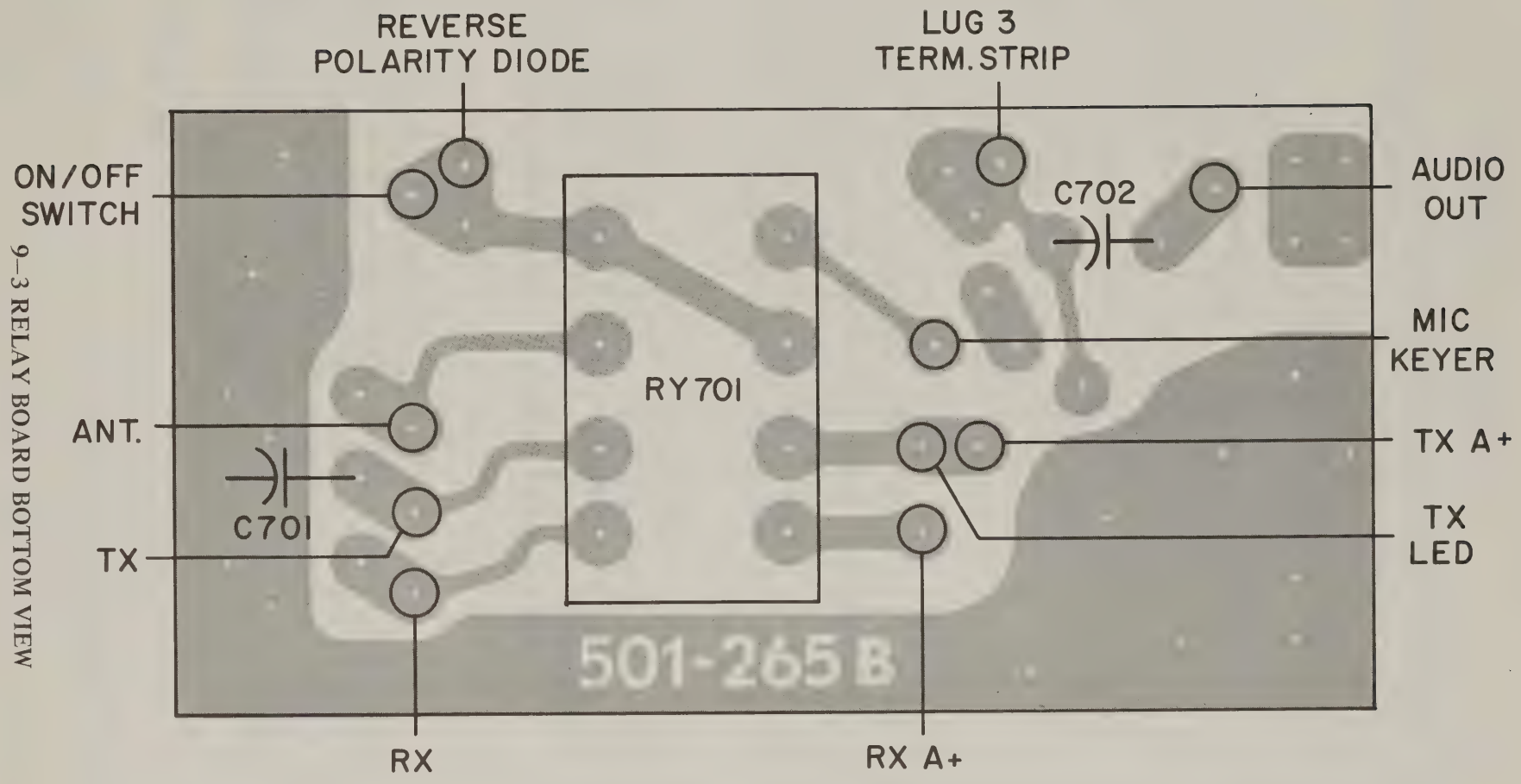
9–1 COMPONENT LIST PLUS CROSS REFERENCE

Item No.	Description	Part No.	Cross Reference Item No.
RY-701	Relay 302-519	4500-3251-900	RY1
C701	CAP CD 15 PF, 10% NPO 50V	1500-0150-650	C1
C702	CAP E 250 μf, 16V 850 Type U	1513-0251-002	C148



9–2 RELAY BOARD PARTS PLACEMENT DIAGRAM

RELAY BOARD 501-265



9-3 RELAY BOARD BOTTOM VIEW

SECTION 10 C.T.C.S.S. ACCESSORY ADDENDUM

This accessory provides a continuous tone coded sub-audible squelch function for the BTL-301 and BTL-304

CONTENTS

10–1 CIRCUIT DESCRIPTION

Detected signal from IC102 is fed to IC801 and IC802; IC801 is a high-pass filter which removes tone frequencies from the audio. IC802 is a low-pass filter which selects the signalling frequency and removes audio, feeding the signalling frequency to IC803 and IC804 which are the filter for the code frequency. IC803 is the frequency determining network and IC804 is an amplifier. IC805 is a detector which, when the proper frequency is present at the filter output, switches Q107 off, unsquelching the receiver.

The Microphone Hang-up Button is connected to Pin 6 of IC804. When the Hang-up Button is grounded, the circuit operates as above. When the Hang-up Button is ungrounded, the decoder is disabled leaving the receiver under noise-squelch control. Also, IC803 and IC804 go into oscillation at the tone code frequency and provide encode tone through R803; the tone deviation control to the transmitter.

10–2 ADJUSTMENT PROCEDURE

a. Connect the unit to a Dummy Load
b. Couple an F.M. Modulation Meter's RF pick-up to the transmitter
c. With the Microphone Hang-up Button ungrounded, key the transmitter
d. Adjust the Tone Deviation Control, R803, for ±0.5 to ±1.0 KHz tone deviation
e. Apply 0.5 to 1.0 volts RMS at 1 KHz audio to the microphone input
f. Adjust Deviation Control, R216, for ±5 KHz composite deviation

10–3 SPECIFICATIONS

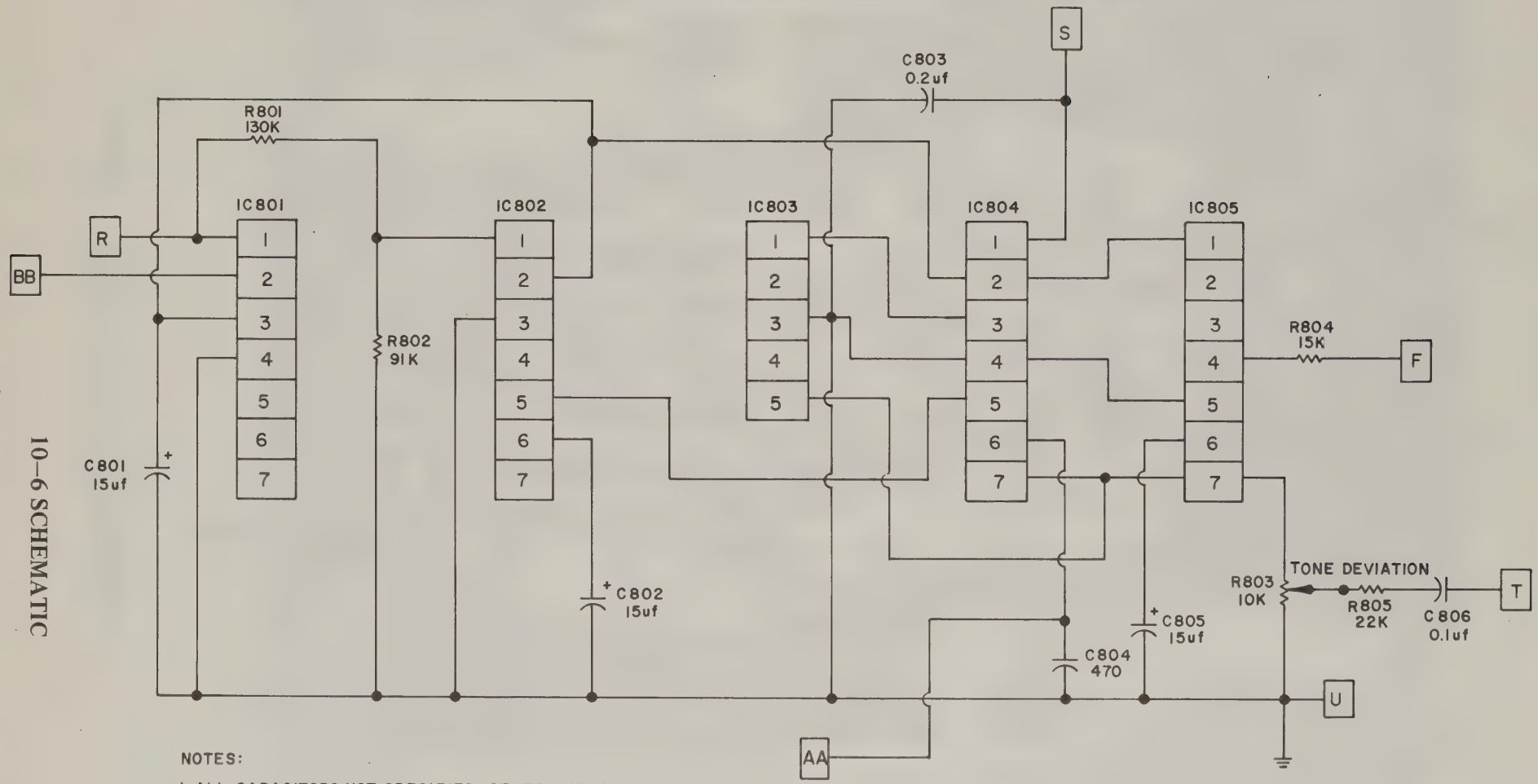
Frequency Range..... EIA Standard Frequencies from 67.0 to 250.3 Hz
R.F. Sensitivity..... 0.15 μv
Response Time..... 325 ms (max.)
Encode Deviation..... Adjustable, 0 to ±1 KHz

10–4 VOLTAGE CHART

	1	2	3	4	5	6	7
IC801	3.8	AC	10	0	NC	NC	NC
IC802	1.6	10	0	NC	6	5.5	
(2)	1.4						
IC803	5.3	NC	0	NC	5.3		
(1) (2)	5.2				5.2		
IC804	13.8	10	5.3	0	6	.1	5.3
(1) (2)			5.2		0		5.2
IC805	10	NC	NC	0	0	3.2	5.3
(1)				7.2		5.6	5.2
(2)				0		3.2	5.2

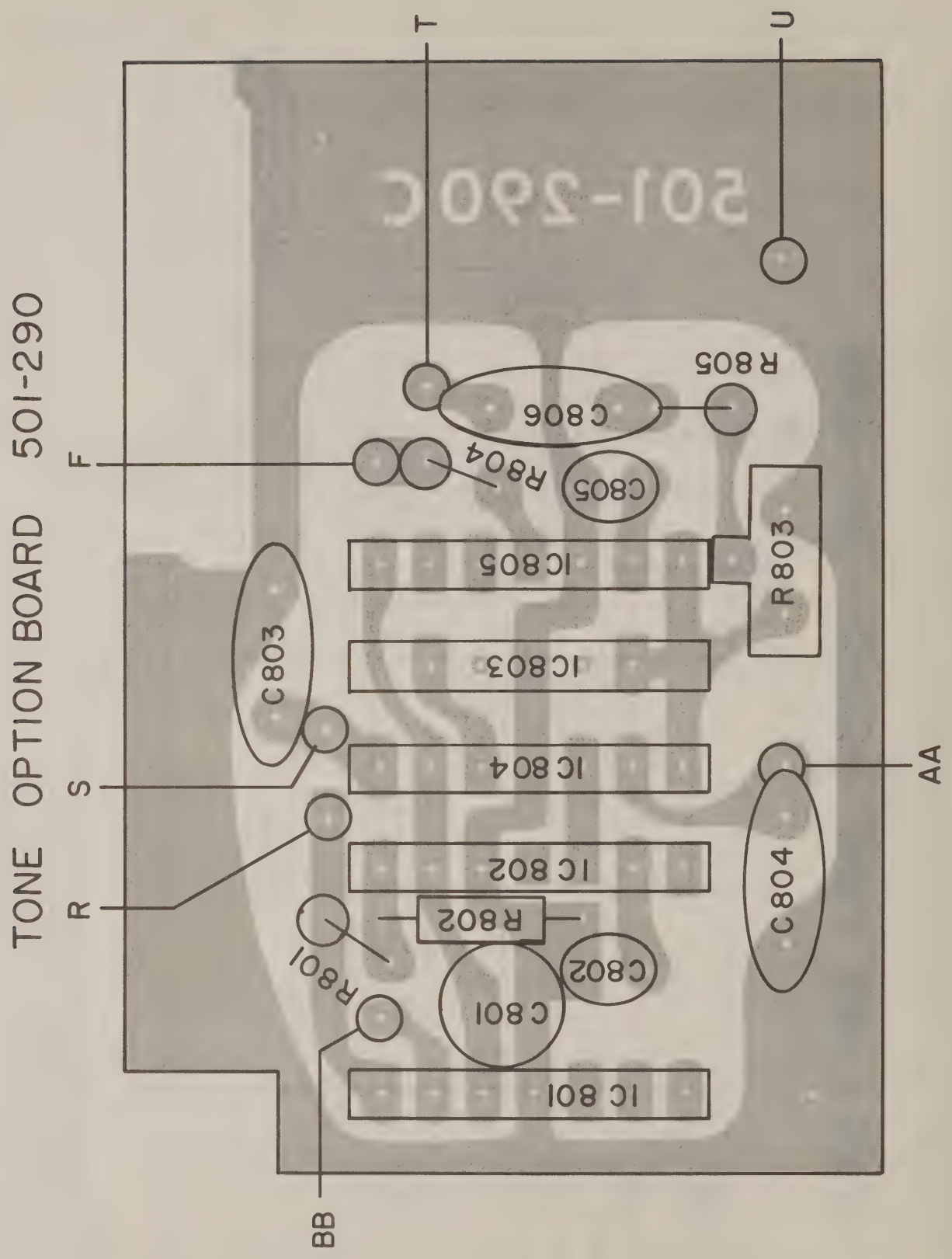
NOTE: All voltages are nominal and were measured with a VTVM, 13.8 VDC supply. Microphone off-hook.
1) Denotes readings with microphone in grounded hang-up clip.
2) Denotes readings with conditions as in 1) and R.F. signal with code tone applied.

ENC / DEC TONE BOARD — 501-290

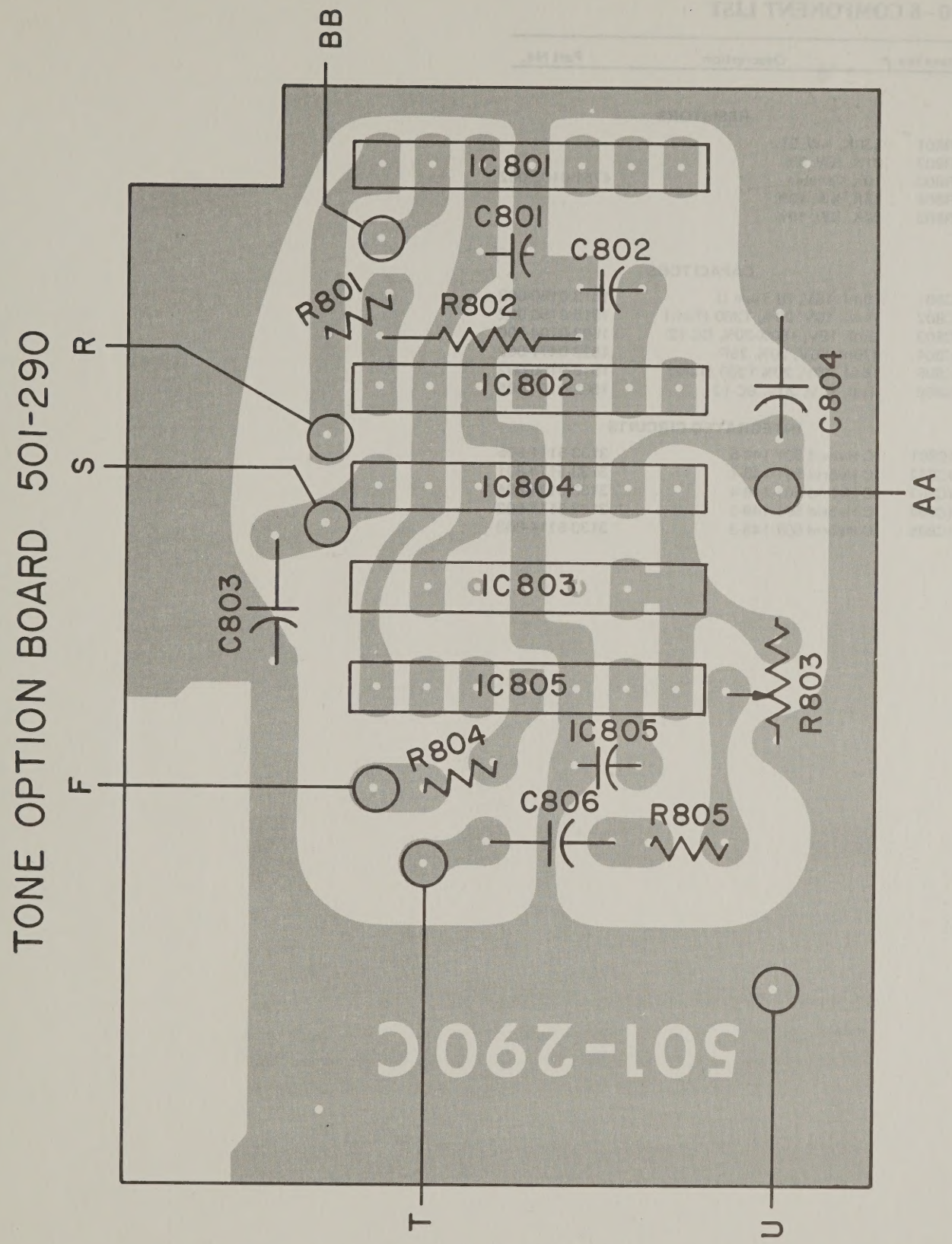


NOTES:

1. ALL CAPACITORS NOT SPECIFIED OTHERWISE ARE PICO FARAD
   ALL RESISTORS NOT SPECIFIED OTHERWISE ARE OHMS
   ALL RESISTORS NOT SPECIFIED OTHERWISE ARE 1/4 WATT
2. REFER TO DRAWING 700-214 FOR BASIC RADIO SCHEMATIC
3. LETTERED BOXES ARE CONNECTION POINTS TO BASIC RADIO SCHEMATIC



10–6 TONE OPTION BOARD PARTS PLACEMENT



10–7 TONE OPTION BOARD BOTTOM VIEW

10–8 COMPONENT LIST

Item No.	Description	Part No.
	RESISTORS	
R801	130K, ¼W, 5%	
R802	91K, ¼W. 5%	
R803	10K Variable	4751-0103-002
R804	15K, ¼W, 10%	
R805	22K, ¼W, 10%	
	CAPACITORS	
C801	15mf, 16V, III Tupe U	1513-0150-002
C802	15mf, 10V, 20%, T360 (Tant)	1515-0150-002
C803	.2mf, 12V, +80%-20%, BC-12	1502-0204-006
C804	470pf, 50V, 20%, 25F	1523-0471-002
C805	15mf, 10V, 20% T360 (Tant)	1515-0150-002
C806	.1mf, 12V, 20%, BC-12	1502-0104-005
	INTEGRATED CIRCUITS	
IC801	IC Hybrid 501-148-5	3133-5114-805
IC802	IC Hybrid 501-148-1	3133-5114-801
IC803	IC Hybrid 501-148-4	3133-5114-804
IC804	IC Hybrid 501-148-2	3133-5114-802
IC805	IC Hybrid 501-148-3	3133-5114-803